Vol. LXXXI FEBRUARY, 1925 No. 2

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

Edited by
LEWIS STEPHEN PILCHER, M.D., LL.D.
of New York
With the Association of
JAMES TAFT PILCHER, B.A., M.D.
and the Collaboration of
W. SAMPSON HANDLEY, M.S., M.D., F.R.C.S.
of London

J. B. LIPPINCOTT COMPANY, PUBLISHERS
MONTREAL PHILADELPHIA LONDON

Entered at the Post Office at Philadelphia and admitted for transmission through the mails at second-class rates. Price, $10.00 a year.

ANNALS of SURGERY

VOL. LXXXI FEBRUARY, 1925 No. 2

NEURO-EPITHELIOMA OF THE SPINAL CORD*

A CLINICAL AND PATHOLOGICAL STUDY

BY JOHN A. HARTWELL, M.D.
AND
LEWIS D. STEVENSON, M.D.
OF NEW YORK, N. Y.
FROM THE NEURO-SURGICAL CLINIC OF CORNELL UNIVERSITY MEDICAL COLLEGE

THE opportunities for the study of tumors of the central nervous system and its meninges are becoming so plentiful that rapid progress in this field may confidently be expected. The early statistics collected by Bruns,[1] Schlessinger[2] and others related to neoplastic growths of all types and only in recent years has it become recognized, that further advance will be made most surely if the study of individual types be made. When, therefore, one observes a tumor of the spinal cord which presents unusual features, the report of such a tumor as an isolated experience is more than justified.

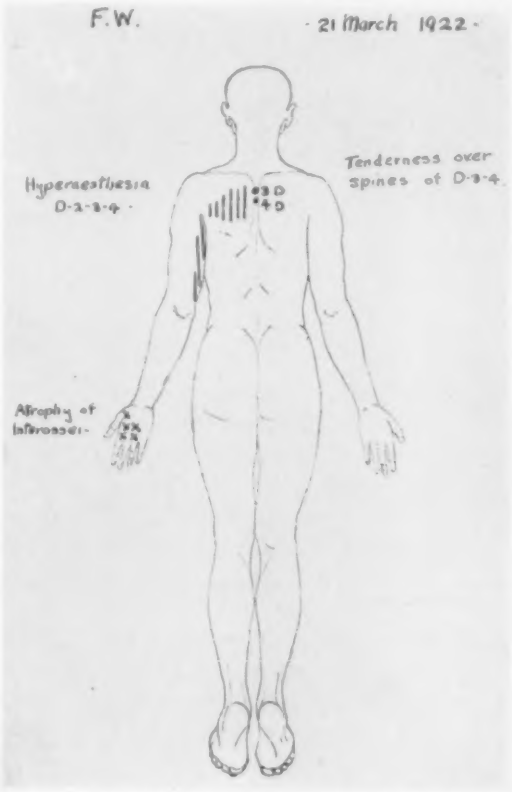

FIG. 1.—Chart showing the objective findings on March 21, 1922. Hyperæsthesia is represented by dark vertical lines.

In attempting such a report one encounters difficulty in determining to what extent the tumor under consideration differs from those described by other observers. The nomenclature used in the literature is confused, and in many instances, particularly of clinical reports, the name applied to the tumor is not sufficiently distinctive, and no histological data are given on which to base accurate information.

The tumor used as the text of this discussion was entirely extramedullary. So far as can be determined it took its origin from beneath the pia-arachnoid,

* Read before the American Surgical Association, April 18, 1924.

the latter membrane passing over it and binding it closely to the cord. It differed from most extramedullary spinal tumors in that it possessed excessive malignancy.

Joppich,[3] in 1903, found only 24 cases of extramedullary leptomeningeal sarcoma recorded in the literature. Schlessinger,[2] in analyzing 224 autopsy findings of cord tumors, includes 107 sarcomas. In many of these reported cases the striking characteristic of extramedullary tumors, even when called sarcoma, is their relative non-malignancy. Hunt and Woolsey [4] report an extradural fibrosarcoma which recurred in fifteen months after removal. A second operation was thought to have incompletely removed the growth and yet recovery took place and the patient reported entirely well four years later. Inglis-Klingman and Ballin [5] report one extramedullary glioma. It was attached to the subpial neuroglia of the cord and the posterior root of the seventh thoracic nerve. Operative removal was successful and the patient was well eighteen months later.

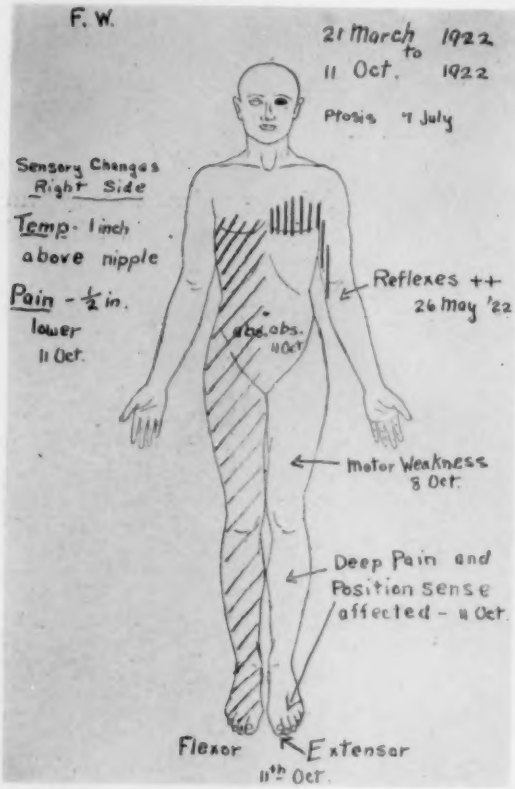

FIG. 2.—Chart showing sensory, motor, reflex, cervical sympathetic changes from March 21 to October 11, 1922. Sensory loss over right side of body indicated by diagonal lines.

Malignant tumors are of common occurrence in the substance of the spinal cord, but in most instances they are definitely infiltrative of the cord which is in marked contrast to the one discussed here. We have designated this tumor as a neuro-epithelioma. Schlapp [6] reports a spinal tumor under this name which occurred as an isolated growth in the dorso-lumbar region of a cord which was the seat of a central gliosis. In this respect it paralleled our tumor. In the literature on the cases of neuro-epithelioma of the cord he finds that all of the authentic and well-examined cases with the exception of one or two are accompanied by a central gliosis. In these exceptions the tumor had destroyed so much of the cord that it would be impossible to say whether there was or was not an underlying gliosis present. Schlapp concludes that a central gliosis is a condition almost constantly found in cases of neuro-epithelioma, and he advances the view that the former stands in a causative relation to the latter. In our case the gliosis seems of a later date than the tumor.

The patient in whom the tumor developed was a woman in her fortieth year, who first came under observation on March 20, 1922. She had been twice married, and was the mother of three children, the last born in June, 1921. There was no suspicion of tuberculosis or lues. Her previous history, except for one incident, was entirely irrelevant. In November, 1919, she was thrown from her horse while hunting, and suffered a "twist of the neck." This caused little immediate inconvenience, but three days later the left shoulder and arm pained her rather severely and became stiff. No evidence of any nerve pain at this time was obtained. She was treated by manipulation and after a few treatments all symptoms subsided. No further pain was experienced until July, 1921, twenty months after the injury, when about six weeks post-partum there was a return of the same pain and in addition a pain under the left scapula. This attack was more obstinate and only yielded after several weeks of treatment with manipulation, electricity, baking and finally a visit to the baths at Hot Springs. She remained entirely free from pain until January, 1922. At first the pain was not severe, but in March there was a sharp recurrence from which she never recovered. On one occasion, some time in February before the pain became severe, she noted an involuntary flexion of the middle finger of the left hand. This had not recurred and there had never been any other muscular involvement. From the onset of this attack in March, the pain had been unbearable, and one or two grains of codeine was taken every night to permit of any sleep. The patient was an unusually healthy appearing woman who gave evidence of being in severe pain. The usual physical examination failed to disclose any defects not connected with the nerve lesion except the presence of a root abscess on one of the upper molar teeth. The presence of this had been known a year previously when it was demonstrated with the radiograph, but it had received no treatment. A neurological examination was recorded in the following note: There is excruciating pain in the entire left upper extremity, including the upper scapular region. This entails some involvement of all the nerves from the fourth cervical to the third dorsal. She describes this pain as tearing, burning and boring. It is made markedly worse by any movement, but becomes unbearable unless the position of the arm is changed from time to time. There is also hypersensitiveness in the arm, forearm and hand, most marked over the distribution from the first and second dorsal segments. There is a definite zone of hyperæsthesia anteriorly and posteriorly along the left second and third costal space showing involvement of the corresponding nerves or the second and third dorsal segments. The cervical and brachial nerve trunks are tender, and light

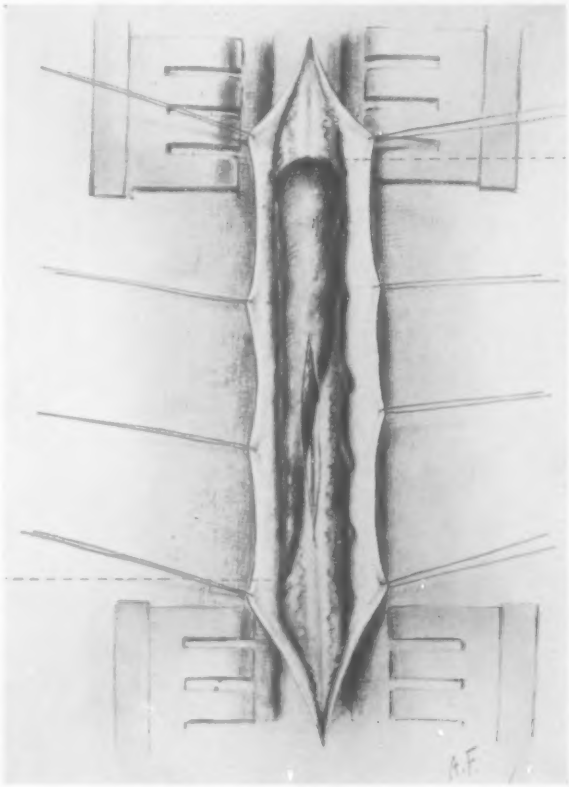

FIG. 3.—Drawing to show the original tumor as exposed at operation covered by the arachnoid membrane.

palpation along their course increases the pain in the scapular and arm regions. The third dorsal spine is tender on percussion as are the first and second to a less degree. Flexion and extension of the neck increases the pain. There is atrophy in the first interosseous space of the left hand, and the whole hand seems smaller than the right. The skin is shiny. There is no paresis or muscular weakness other than that due to pain on using the muscles. There are no changes in any reflexes of the trunk or lower extremities. Those of the left arm and hand seem normal, though pain disturbs the examination. An X-ray examination of the molar tooth confirmed the presence of the abscess and two days later the tooth was extracted and the abscess cavity cleaned. An X-ray examination of the spine and upper extremities revealed no abnormalities and no cervical rib was present. A tentative diagnosis of a cervico-dorsal radiculitis was made, with the tooth abscess as an etiological factor, though the fear of a neoplasm of the cord or spine was entered in the notes on that occasion.

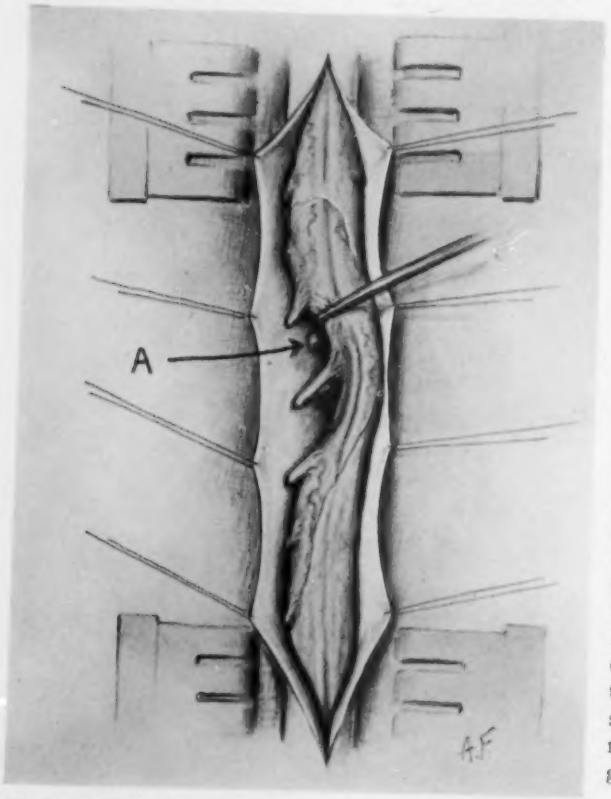

FIG. 4.—Drawing to show a secondary tumor nodule lying in the dura mater as exposed at operation. A—Secondary nodule in dura.

On March 22, Dr. Frederick Tilney saw the patient in consultation, when the following note appears in the record: "Doctor Tilney confirms the findings as given and concurs in the interpretation of neuritis or radiculitis, with however, the possibility existing of vertebral or medullary lesion," probably neoplastic (?). Doctor Tilney emphasized the fact that the hyperæsthesia extends to the distribution of the posterior dermatonic divisions of the lower cervical nerves. Such findings suggested an intravertebral lesion.

The usual treatments were instituted and on March 31, the following note was made: "The patient seems to have improved in general condition and the pain is slightly less some of the time. Treatment has been absolute rest with application of heat, anodynes being given sparingly. Seen with Dr. Foster Kennedy who confirms all the findings and believes the condition is a pachymeningitis around the foramina for both the cervical and dorsal nerve roots. He thinks this would account for all symptoms, the process being more extensive than usual. He finds nothing on which to base the diagnosis of a bony or medullary neoplasm at this time. Advises addition of salicylates to the treatment."

The course of the condition continued unchanged for the following six weeks. There had been no real cessation of pain and it had been necessary to give anodynes rather freely. Repeated examinations failed to show any symptoms which would implicate the cord itself in the picture. The pain had been so excruciating that the patient's general condition was suffering, though no more than is often seen with a severe cervical radiculitis.

On May 26, Doctor Kennedy again saw the patient. He could find no new manifestation, except the sympathetic involvement, mentioned below, and an increase in the left arm reflexes, and adheres to the diagnosis of posterior root pachymeningitis, with pressure. He thinks there is only a minimal involvement of the anterior roots. In general he finds an improvement since the last visit. The reflexes, with the exception named above, are all normal, and it is particularly noted that the abdominal reflexes are equal and brisk. The hyperæsthesia seems less severe, but the zone on the chest is more extensive now involving the eighth cervical and first dorsal segments. The atrophy has not increased. There are no anæsthesias or pareses demonstrated. An additional symptom was noted at this time—the nurse first observed it a day or two previous to this visit—in the presence of a false ptosis of the left eyelid and inequality of the pupils, the left being smaller than the right, an involvement of sympathetic fibres. Later marked unilateral sweating of the face was present. We continued in the belief that we were dealing with an inflammatory lesion which possibly had its cause in the tooth abscess, though the correction of this had disappointed our hope that a cure might follow. An examination of the stool showed an excessive fermentation, with heavy content of streptococcus viridans, and it was considered possible that the irritation was kept up from this source.

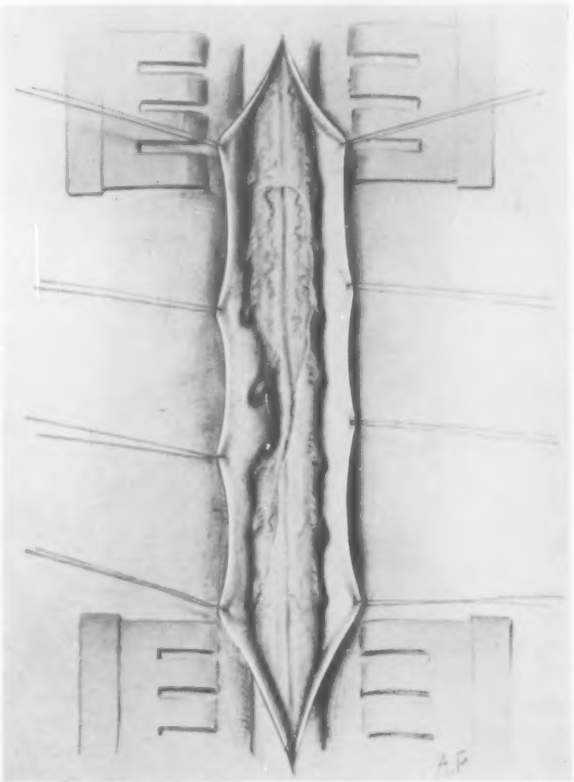

FIG. 5.—Drawing to show appearance of the cord after operation.

Repeated examinations failed to add a single finding which would confirm the suspicion constantly in our minds that a cord neoplasm was present. There was nothing in the picture which was incompatible with a simple cervico-dorsal radiculitis. The very intensity of the pain, its constancy and its type were all in accord with this conception.

July 5, 1922. The progress has been slowly toward recovery. The anodyne (morphine mostly) which had been required in increasing amounts, was withdrawn during the middle of June. Since that time the patient has been without anything to relieve pain other than an occasional dose of luminol or trional to induce sleep. The pain had grown intermittent so that sometimes she would be free for several hours and on occasion would sleep all night without medication. At times, however, she had very severe burning sensations around the elbow on the inside of the arm (1st dorsal segment) and sometimes in the hand. There were also clonic contractions of the arm muscles, mostly the anterior group, which were painful. These could be controlled by mental influence and reassurance, and were believed to be more due to a lowering of her morale from the long suffering than from an anterior root irritation. Voluntary use of the extremity had improved and the muscular atrophy seemed decreasing.

The streptococci in the intestine were still abundant and for this she had been receiving an acid bacillus tablet with milk sugar and an autogenous vaccine.

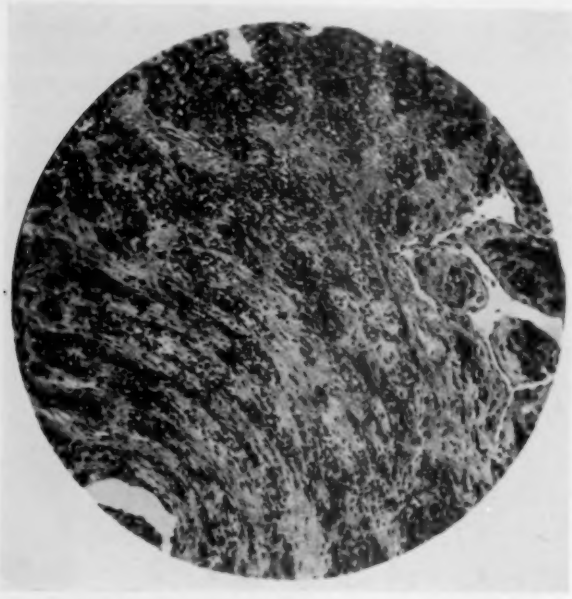

FIG. 6.—Low power view of section from the original tumor removed at operation.

During the summer months there seemed to be a slow but steady improvement. The atrophy of the hand and arm muscles became less marked, and the intense pain was absent for considerable periods. The patient was up for a time each day, and sleep was obtained with small amounts of alinol. Repeated examinations failed to show any changes other than those recorded at the first examination. No alteration in any reflexes were ever observed. There was no loss of any form of sensation in any part of the body. No paralysis or paresis could be demonstrated. The painful clonic contractions of the upper extremity had stopped. There was still hyperæsthesia and hyperalgesia in the region of the left scapula, left arm, forearm and hand, and the region of the left third costal space anteriorly and posteriorly. The improvement seemed to be coincident with freeing of intestine from the streptococcus and thereby lent support to the belief that we were dealing with a toxic cervico-brachial radiculitis.

About the middle of September fears of a neoplasm were again aroused by the appearance of a pain beneath the right scapula and a tingling sensation in the right hand. These were transitory and not very definitely localized by patient, but at times were quite severe. On one occasion the nurse reported that patient had commented on some peculiar sensation in skin of right thigh and groin, a passing illy-defined phenomenon. This was the first evidence that any cord disturbance might be present, but a thorough examination failed to reveal any finding which would confirm this.

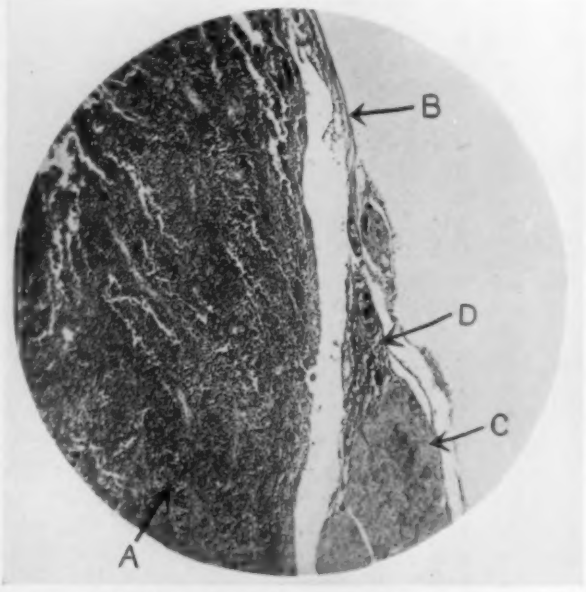

FIG. 7.—Low power view of tumor removed from antero-lateral aspect of cord at autopsy. A—Tumor composed largely of cells (neuro-epithelioma). B—Arachnoid membrane covering tumor and nerve root. C—An anterior nerve root stretched over the tumor. D—Tumor cells invading sheath of nerve root.

October 7. The pain in the right upper extremity has increased and at times has been very severe in the neighborhood of the scapula. There has been no abnormal sensation in the hand. The left upper extremity seems to be constantly improving. The pain is definitely lessening. Atrophy is decreasing and the ability to move the arm without undue pain is greater. There is added to-day a new symptom, a weakness in left lower extremity when walking so that some part of the extremity—patient thinks near hip-joint—seems to give way. This is not present at all times. There is also described in the right lower extremity various paræsthesias, "as though asleep, and there is a creeping sensation as though I can feel the blood circulating under the skin." There is no actual pain, and no pin and needle sensation. These findings make probable a cord compression.

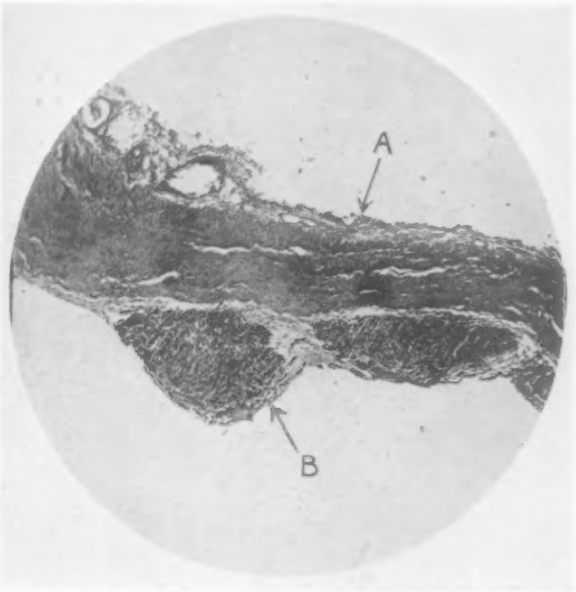

FIG. 8.—Metastatic nodule on under surface of the dura mater near the original tumor. A—Outer surface of dura mater. B—Metastatic tumor nodule.

October 11, 1922. Neurological examination made today gives the following findings: In the upper extremity there is a continued improvement on the left side in every respect. No changes are found in the right extremity. The reflexes are present and are apparently equal on both sides. The same tenderness, though less marked, as originally existed in the spinous processes of the upper dorsal vertebræ is present. No fibrillary muscular contractions are present. The abdominal reflexes are altered on both sides: on very excessive stimulation there is a response on the left side but none on the right. The knee reflexes are slightly exaggerated on both sides and ankle-clonus is present on both sides. There is a doubtful Babinski present in the left great toe. The eye condition is still present though less marked than formerly.

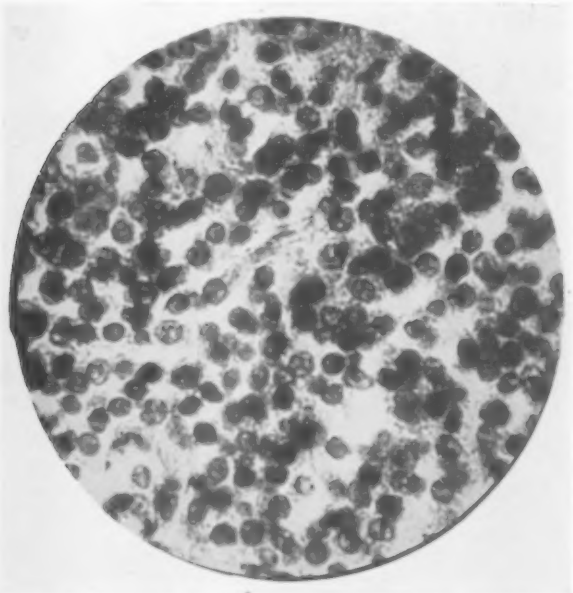

FIG. 9.—High power view of tumor cells to show the neuro-epithelial cells with intercellular fibrils.

Sensation.—Below the

level of the second dorsal segment on the right side there is a definite dullness of sensation both to tactile and painful impressions. The patient says that everything feels as though the part were numb. There is a definite loss of appreciation of hot as compared with cold stimuli below this level. There is much disturbance of deep pressure pain sense and of the sense of position in the left calf and foot respectively. There are no sphincteric disturbances. The left lower extremity is definitely weaker than the right but the patient can walk with no perceptible limp. All these find-

FIG. 10.—Section of the spinal cord above the level of the tumor to show pencil of gliosis within the cord. A—Area of gliosis.

ings seem to indicate a pressure on the left side of the cord at the first or second dorsal segment.

October 12, 1922. Seen by Dr. Van Horne Norrie in consultation. He agrees with all the findings in the examination and arrives at the diagnosis of compression of the left side of the cord, probably of tumor origin, though of course this is uncertain. While the centre of the compression is at the first or second dorsal segment, it must also reach up to the fourth or fifth cervical in order to involve the brachial plexus, and may readily extend down to the fourth or fifth dorsal because of the root pains on the right side extending down to the fifth or sixth segment.

A spinal cord tap was done and 3 or 4 c.c. of an orange-tinted fluid withdrawn under low pressure. An examination of the spinal fluid was as follows: Bright yellow fluid which did not clot on standing. Clear—small amount of macroscopic blood in bottom of tube.

Cells—5 per cm.—smear showed very few cells—all mononuclear.
Culture—sterile.
Albumin—3 plus.
Globulin—2 plus (Noguchi and Nonne).
Sugar—2 plus.
Wassermann—negative.
Colloidal Gold Curve—negative.

October 17, 1922. From the previous note until this date when the operation was performed there was a steady increase in the symptoms of a cord compression. The right side below the level of the second dorsal segment showed a loss of sensation of all types. The left lower extremity was almost completely paralyzed and the right had grown so weak that the patient could not bear any weight upon it. All reflexes were exaggerated except the abdominal which were completely absent and there was a marked Babinski on the left and a doubtful one on the right.

A laminectomy was performed according to the usual method, the laminæ of the sixth

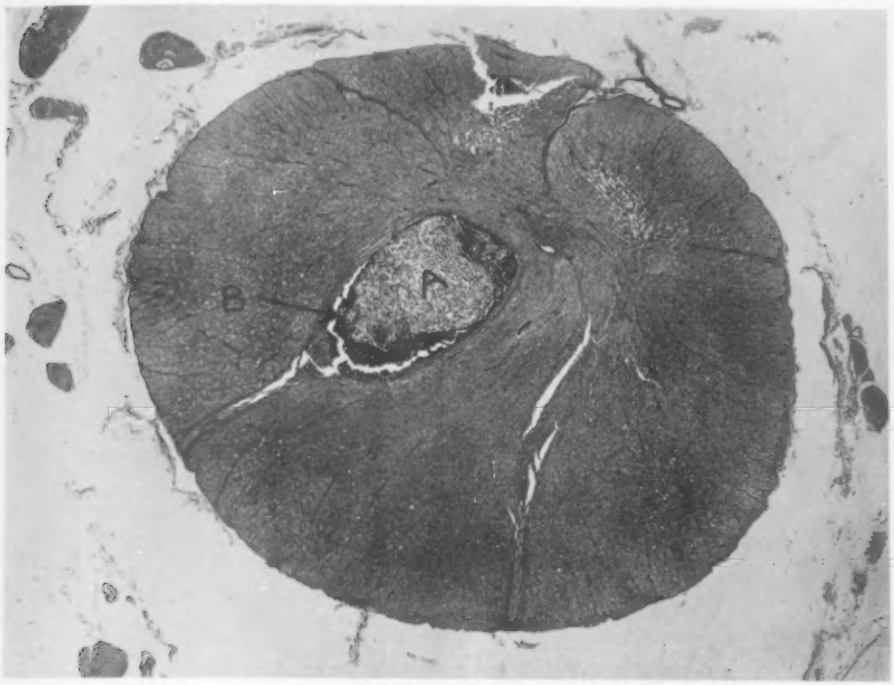

FIG. 11.—Section of the spinal cord below the level of the tumor showing the pencil of gliosis within the posterior horn of the cord. A—Gliosis. B—Zone of hemorrhage about the gliosis.

and seventh cervical and four upper dorsal vertebræ being removed. The tumors as described below were removed by sharp dissection without difficulty and with no undue trauma to the cord. The left lateral aspect of the spinal cord beneath the laminæ of the sixth and seventh cervical and first and second dorsal vertebræ was the site of a club-shaped, very friable, cellular appearing tumor. The thicker portion of the tumor was opposite the sixth and seventh cervical laminæ, and the thinner portion opposite the first and second dorsal laminæ. The tumor was a dark purplish color and was intimately adherent under the arachnoid to the substance of the spinal cord. It has very seriously compressed the cord at the level of the first dorsal segment, but had not extended around the cord either anteriorly or posteriorly. The compression appeared to have been due to the tumor's position beneath the arachnoid, and not because of any lack of room in the spinal canal. Opening of the dura did not relieve the compression.

If the spinal cord and tumor had been removed intact and hardened in formalin before section, the shape of the tumor would have been as follows: "Beginning above, at a point beneath the interval between the fifth and sixth cervical laminæ, the tumor was spread out over the left lateral aspect of the cord and retained thus by the arachnoid. Descending downward, the superficial envelopment of the cord by the tumor laterally became rather less but the extent of growth from left to right increased to a maximum

point opposite the first or second dorsal segment in such a way as to exert more pressure on the cord at this point than it did above, where the surface expansion was greater. From this latter point downward, the tumor gradually thinned out in all its diameters. From the clinical symptoms and this shape of the tumor it is fair to assume that the tumor made its first appearance close to the first dorsal segment, and at first grew between the arachnoid and cord as a more or less rounded mass. As resistance increased, it extended upward as a thinner more enveloping growth between the cord and arachnoid, and downward as a thin tapering off growth.

The growth had involved the eighth cervical and first and second dorsal posterior

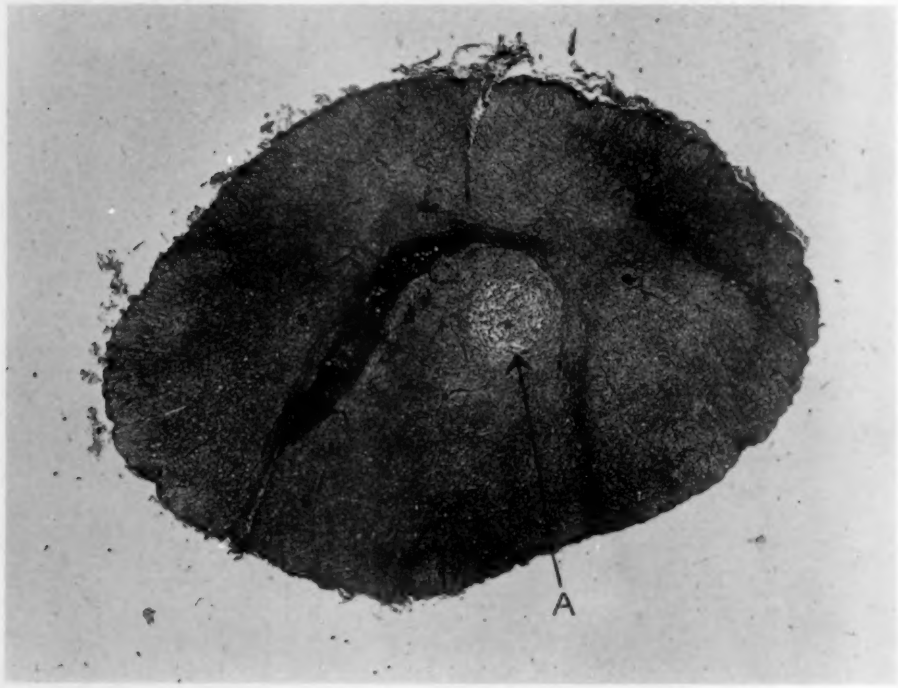

FIG. 12.—Section of the cord lower down than in Fig. 11 to show an additional area of gliosis within the white substance of the posterior column of the cord at "A."

nerve roots on the left. These nerve roots were so intimately mingled with the tumor that they could not be liberated and were of necessity divided during the removal of the growth. The anterior roots were left intact, the tumor being entirely behind them.

After the tumor had been removed the cord was lifted from the body of the vertebræ and thoroughly inspected anteriorly. No evidence of any further tumor could be found except for a small node about 3 mm. in diameter lying in a pit in the dura opposite the body of the first dorsal vertebra.

At the time of operation we were unable to determine the source of this tumor, whether an extension of the large tumor or an independent growth. The cord lying behind it was, by a thorough inspection, found to be free from tumor tissue. This was the only point at which the dura was involved in the lesion, and here the growth gave no evidence of having penetrated into the dura itself. The large tumor was removed without breaking it by dividing the arachnoid membrane and lifting it away from the cord. This was accomplished by sharp dissection aided by the use of moist cotton tampons. There was no laceration of the cord and at no point was there any bleeding from the pia vessels. The small node in front of the cord was lifted out of its dural pit intact by

means of a sharp bone curette. Careful inspection of the cord revealed no additional tumor tissue and no evidence could be found that tumor tissue involved either the cord or the dura. No evidence of a central gliosis was obtained.

After removal of the tumor it was seen that the cord was pushed well to the right side of the canal and was compressed on the left lateral aspect to one-half or less of its normal diameter.

As presented to Doctor Elser the "new growth was a soft and pliable tongue-like piece of tissue measuring 4½ cm. in length and 1¼ cm. in breadth and 4 mm. in thickness in the middle portion, tapering off toward the ends which were less than 1 mm. in thickness. The tissue had a flesh colored appearance resembling that of the spleen. The outer surface was smooth and glistening, the under surface presented a coarsely granular appearance and the structure suggested that the growth consisted of congeries of blood-vessels which led to the tentative diagnosis of an angio-endothelioma. In general it reminded one of a somewhat congested choroid plexus. Specimen No. 2 was a small piece of tissue the size of a lentil which was an isolated growth and macroscopically not connected with the main tumor. It was composed in part of blood clot and in part of tumor tissue.

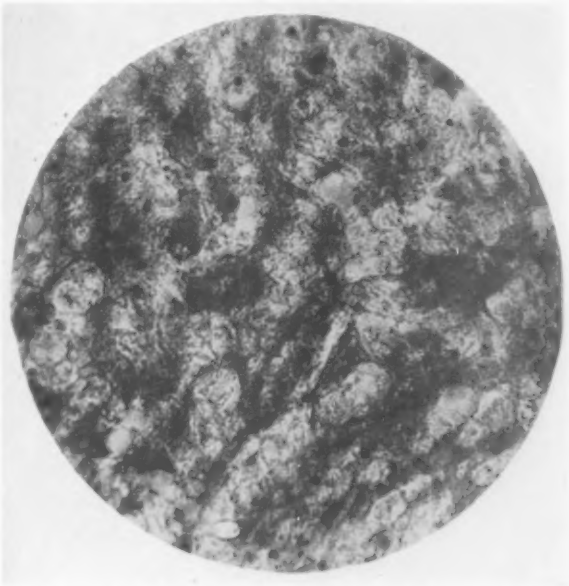

FIG. 13.—High power view of gliosis seen in Figs. 10 and 11.

On the fourth day the evidence of operative damage to the cord began to subside, and by the seventh day power had returned in both lower extremities. The return of pain and temperature sense to the right half of the trunk and right lower extremity was complete—these having both been lost prior to operation. Muscular sense and sense of position had returned to the right lower extremity, but was noted on the twelfth day as absent in the left. The patient would carry out any muscular act requested with the left lower extremity, but unless she could see the part, had no knowledge that she had done so. Ankle clonus was still slightly present and knee reflexes were exaggerated, but decreasingly so. The pupils were still somewhat contracted, and the left lid ptosis (sympathetic) is present. The pre-operative root pain was present, but to a markedly decreasing degree.

The course of the disease after the date was marked by constant changes in symptoms which were not explained on any basis of a change in organic lesion. For a period there seemed to be a slight but steady improvement in muscular power and paræsthesia below the level of the second dorsal segment. Both lower extremities could be moved with considerable power in all muscles. At times there was, apparently, a correct appreciation of pain and temperature sense in the right body and lower extremity. Sphincteric action was normal. Reflexes exaggerated—abdominal absent—and the Babinski less marked. The contraction of the left pupil and the ptosis were less marked. The line of sensory disturbance on the body had gradually passed downward from the second dorsal to the eighth and tenth dorsal segments. On one occasion she experienced great tenderness in the post cervical region—fifth and sixth vertebræ and marked rigidity of neck. This lasted

several days, but gradually wore away without being explained. So far as could be determined the root pains were growing less all the time, though on occasion she complained bitterly of them, sometimes on the right side, but most often on the left. There was little, if any, change in the left arm atrophy. Her general condition was fair though she was poorly nourished and showed markedly the long painful strain.

December 4, 1922. The picture is markedly changed in the past forty-eight hours. The paralysis of the lower extremities is complete, the reflexes are lost except for a slight knee jerk. No sensation of any kind is present from the original line of hyperæsthesia (2nd dorsal) downward. The advance upward from the spines of the ilia (which was the line four days ago) has been progressive. The most probable explanation at the present time is that a recurrence of the tumor has taken place at the original site with possibly other tumors at other sites. In any case there is every evidence of a complete transverse block of the cord at the second dorsal segment.

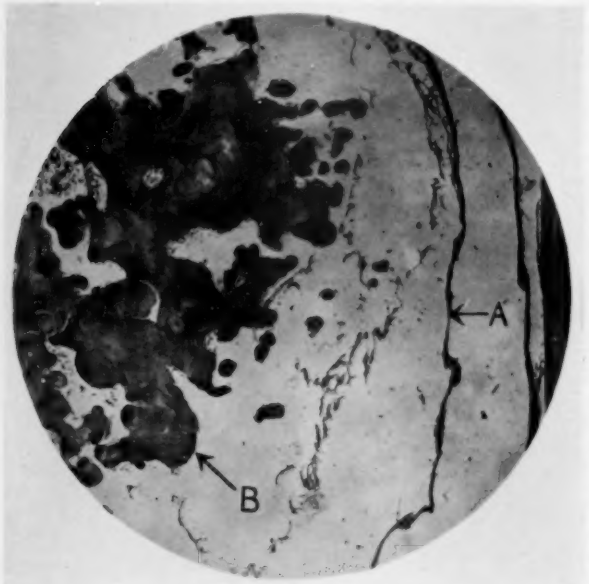

FIG. 14.—Section of one of the small bony plaques found in the arachnoid below the level of the tumor. A—Arachnoid. B—Bony plaque.

December 5, 1922. Temperature ranged very high reaching 107.8. No changes in neurological examination that could be determined though the delirium which the patient developed made observations inaccurate. Respiration became of the Cheyne-Stokes type, and later very shallow sighing in character. Death occurred at 10:30 P.M. caused by respiratory failure of bulbar origin.

Autopsy.—Reported by Doctor Elser. Recent scar in median line of back extending from fifth cervical spinous process to fourth dorsal spinous process. Dissection of scar shows perfect union in deeper parts and no evidence of infection. The spinous processes and laminæ of the sixth and seventh cervical and of the first, second, third and fourth dorsal vertebræ are missing. The exposed dura is fairly tense in this region and shows a thickened band in the middle line extending longitudinally for a distance of about 4 cm. This band measures about 5 mm. at its widest portion, gradually tapering off at both ends and in its most prominent portion is about 3 mm. in thickness. It consists of a fairly soft tissue, red in color and looks not unlike granulation tissue. Its resemblence to the original tumor is sufficiently striking to raise the question of recurrence or implantation. Upon opening the dura the cord appears as a soft, almost diffluent mass of medullary tissue involving a segment about 2 cm. in length. Above and below this point the cord is normal in consistence. The whole cord from the second cervical to its lower end was now exposed and apart from small masses of altered blood found in the subdural space in the middle and lower dorsal region and the accumulation of a considerable amount of straw colored fluid at the low end the regions below the site of the operative field present nothing unusual. Spinal fluid was withdrawn from the lower dorsal region for bacteriological examination.

On the anterior aspect of the cord above the area of compression myelitis referred

to above there is a flat almond-shaped tumor mass identical in appearance with the original tumor. In the recent state it measures about 1.2 cm. in length, 6 mm. across at its widest point and 3 mm. in thickness. It is not adherent to the dura and appears to be covered with arachnoid. Tissue similar in consistence, structure and appearance is found in the root canals surrounding the nerves as they emerge from the spinal canal.

Microscopic examination of this tissue and of the thickened band corresponding to the line of incision through the dura shows it to consist of tumor tissue.

Bacteriological examination of the spinal fluid yielded negative results. The cord was fixed in formalin and sent to Cornell for a more detailed examination.

The illustrations show very well the situation and the general appearance of the tumor as found at operation and of the cord and the secondary tumor found at autopsy.

FIG. 15.—Section of an eye affected by neuro-epithelioma of the retina (so-called "glioma retinæ"). A—Intra-bulbar portion of the tumor which shows typical rosette formation when viewed under high power. B—Extra-bulbar portion of tumor which is devoid of rosettes and resembles the tumor described in this paper. (Section loaned by Doctor Samuels.)

At autopsy the cord was seen to be practically in two pieces, the combined pressure of the two tumors having almost destroyed it about the level of the first dorsal segment. Lying approximately at the level of the original tumor, but on the left antero-lateral aspect of the cord, was a tumor measuring 2 cm. long, 1¼ cm. wide and ¾ cm. in thickness. This tumor was irregularly oval in shape and lay upon the cord and beneath the arachnoid. An anterior nerve root stretched over this tumor and was adherent to it. The right lateral border of this tumor reached past the midline of the cord in front and seemed unattached to the cord at this place. The left lateral border of the tumor cannot be defined for it fuses with the dura and with the broken down cord as it curves around to the left and posteriorly. The tumor is grayish in color but darker than the cord itself. It is streaked here and there with reddish-brown. It is firm to the touch, but a little softer than the normal cord. It occupied the exact site from which the small anterior tumor was removed.

The dura for a distance of about 7 cm. along the left lateral aspect of the cord, in the region of the tumor, is discolored, thickened, and indurated. It is slightly adherent to the tumor in front. The inner surface of the dura here and there in the vicinity of the tumor is studded with smooth, lentil-shaped elevations resembling fat, but, as sections later proved, were not nearly so innocent. The only other notable feature of the cord before section was a number of small, very white, bony plaques in the arachnoid here and there at levels below the tumor, the largest being not more than ½ cm. in diameter.

Sections from the original tumor are composed of cells in masses and strands separated here and there by delicate fibrils. The strands of cells are often split by wedges of hemorrhage. The secondary tumor and other local metastases are much more cellular in character and fewer hemorrhagic areas are seen. The cells composing the tumors are round or oval and have a large lightly blue staining nucleus usually round or oval in shape with a well defined, granular nuclear membrane. Within the nucleus is a delicate but well stained chromatic network. There is a round nucleolus which stains somewhat less distinctly than this network. Surrounding the nucleus is a scanty, ill-defined cell protoplasm and between the cells can be seen, here and there, delicate, ill-stained, fibrils.

These fibrils do not stain well with eosin, and not at all by Mallory's phosphotungstic acid hæmatoxylin.

There is only occasionally seen a tendency to rosette formation.

On sectioning the cord above and below the site of the tumor there was found an oval pencil of what appeared to be hemorrhage running up and down the cord in the left, posterior horn. This could be traced upwards for about one inch and downwards for about one and one-half inches from the destroyed portion of the cord. Microscopically it is composed of proliferated glia tissue forming the central portion of the oval and hemorrhage forming an outer lamina about the gliosis. In the hemorrhagic zone can be seen numerous cells loaded with deeply staining pigment granules. In one place below the tumor, near the lower end of the pencil of hemorrhage there was found a small, round, area of rarefaction in the white matter in the right, cornu-commisural zone of the posterior column. This appears to be another small focus of gliosis but without associated hemorrhage as in the case of the area within the left posterior horn just described. Secondary degeneration of both pyramidal tracts can be seen in sections of the cord below the tumor.

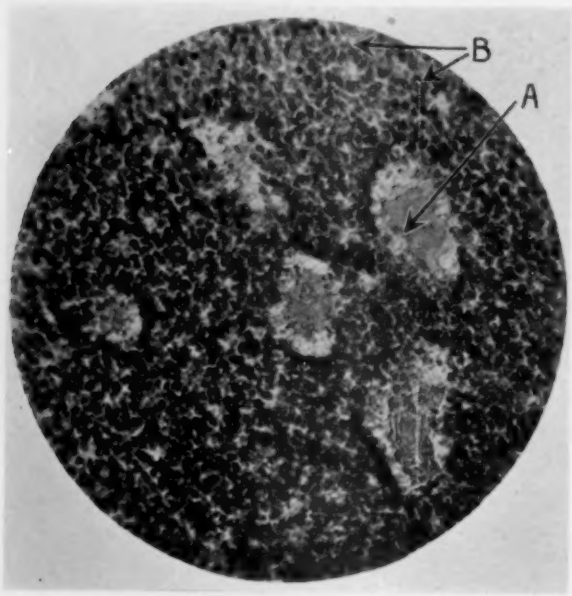

FIG. 16.—High power view of intra-bulbar portion of tumor shown in Fig. 15. A—Typical "rosette" formation of neuro-epithelioma. B—Secondary or smaller rosettes so often seen in neuro-epithelioma of the retina.

We have designated this tumor a neuro-epithelioma because it possesses the structure of such a tumor and we believe this name most accurately describes its characteristics.

Most of the descriptions of neuro-epithelioma refer to tumors of the suprarenal bodies or of the retina (so-called glioma retinæ). Only a few of these tumors discovered in the spinal cord or brain seem to have been described in the literature.

Neuro-epithelioma may be taken to mean the same thing as neuroblastoma or neurocytoma and, indeed, Ewing [7] describes neuro-epithelioma as one of the three structural forms of glioma, stating that the "adult form of glioma consists of well-developed glia tissue, but in many embryonal tumors undifferentiated neural epithelium appears and the tumors are called neuro-epithelioma." Although there is some objection to it, the term gliosarcoma has often been used to describe the very cellular type of tumor composed of round or spindle glia cells deficient in fibrils.

Mallory [8] defines a neuroblastoma as "a tumor of epiblastic origin of which the cells tend to differentiate into nerve cells."

Since the nerve cells in the central nervous system and outgrowths from it like the eye, ear, and the sympathetic system, differ much in appearance

and function, it is to be expected that neuroblastomas originating in these various places will vary somewhat in appearance. For example, a neuro-epithelioma arising from the internal granular layer of the retina is usually composed of cells which are smaller than those composing the suprarenal tumors, although otherwise the tumors are not unlike. (See Figs. 16 and 18.) The constant tendency of these tumors, whether found in the brain, the cord, the retina, the medulla of the adrenal or elsewhere, is to form cells with a prolongation of the cytoplasm at some point into an axis cylinder or nerve fibre. In addition these cells have a tendency to arrange themselves into little balls or spheres which, when cut through, give the appearance of "rosettes" with the neurofibrils running in tangled masses toward the centre. If the tumor is not too rapidly growing and the cells have had time to become differentiated, then the fibrils are well developed, and can often be readily demonstrated by eosin in ordinary preparations stained by hæmatoxylin and eosin. Such examples of the tumor are less malignant than the more cellular types where the fibrils are few and may resist staining by eosin, and even the specific stains for neuroglia and neurofibrils. The tumor we are describing in this paper is of the latter type.

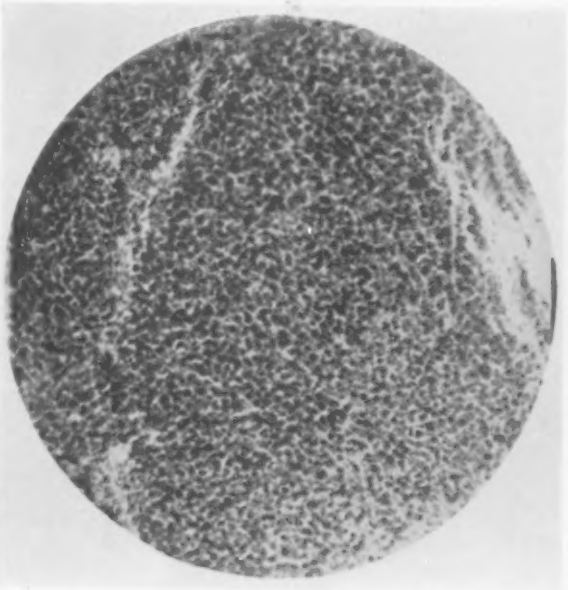

FIG. 17.—Section of the extra-bulbar portion of tumor shown in Fig. 15 showing absence of rosette formation. The cells of the retinal neuro-epithelioma are smaller than those of the spinal cord and adrenal tumors.

In addition to the sites of occurrence already referred to, neuroblastomas have been found to arise at the root of the lung, in the sacral region, in the region of the scapula (Symmers),[9] the inner side of the thigh, probably originating from the femoral sympathetic plexus (Ewing),[10] and in the retroperitoneal region. Symmers says "that the recognition of primary neuroblastomas in almost any situation in the body may be safely predicted is signified by the fact that undifferentiated nerve cells migrate from the embryonal nervous system to form the nerves and ganglia wherever encountered."

It seems to be true also that the more embryonal type of tumor may develop within an ordinary glioma as described by Uyematsu[11] and others. Schlapp (*loc. cit.*) believed that in his case the neuro-epithelioma developed as a result of operation in a case of syringomyelia. In our case the more

embryonal type of tumor was at least associated with gliosis of the cord, although the exact relationship between the two processes is not clear. The association of neuro-epithelioma with ordinary glioma or gliosis is not surprising when we consider that the neuroglia has a common origin with the nerve cells and their processes, from the cells of the neural groove.

The cases of neuro-epithelioma of the cord and brain have been found in older people than is the case with the retinal, sacral and suprarenal tumors. Symmers' case in the scapular region was in a man of forty-four. Schlapp's case was in a man of forty-three. Our own case was in a woman of forty. Symmers' case and our own followed some time after an injury, although the relation of this to the subsequent tumor formation is no more clear than in many associations of this kind.

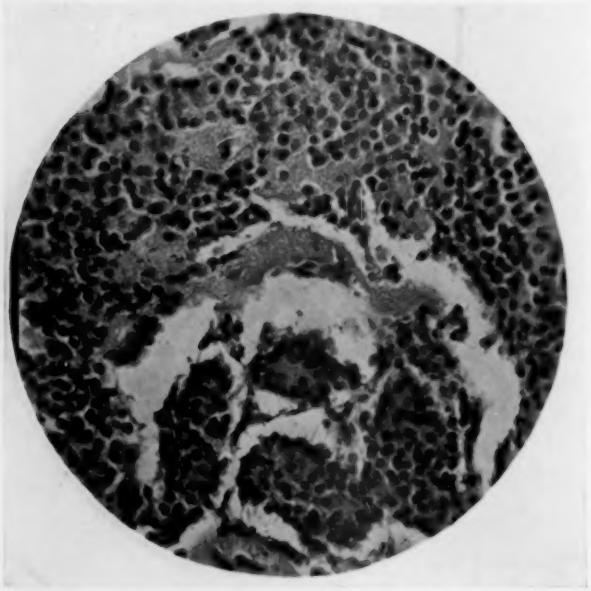

FIG. 18.—Section of a neuro-epithelioma of the adrenal showing rosette formation and also formation of neurofibrils without typical rosettes. (Dr. James Ewing's Section.)

The tumors of the retina and suprarenal are very malignant, forming metastases in distant organs such as the liver and brain. Our tumor is also a malignant one forming local metastases and very rapidly growing, especially after operative interference. In this respect, at least, such tumors differ greatly from ordinary kinds of glioma.

From our introductory paragraph it may be judged that we look upon neuro-epithelioma as a tumor which develops from embryonal, undifferentiated nerve cells wherever these cells may wander to in course of the development of the central nervous system or its outgrowths. Many of these tumors in the retina, the suprarenals and the sacral region have been congenital, and, in the case of the retinal tumors at least are rarely found after the first few years of life. Wintersteiner [12] believes that in the case of glioma retinæ the tumor arises from the growth of misplaced elements of the outer granule layers.

The study of the cord and the tumor give our conception of the nature of the tumor. There are important considerations coördinating the pathological process with the clinical course. It is difficult not to associate the trauma with the development of the subsequent lesion. While there were intervals after the trauma when symptoms were not present, the patient

connected the pain with the injury, and subsequent developments demonstrated that the lesion coincided closely with the site of the injury.

The tumor lay beneath the arachnoid. This may readily have been the seat of a pial hemorrhage and other damage from the injury. The reported cases of close association between trauma and cord tumor make it probable that injury to the nervous tissue is more prone to be the starting point of tumor formation than in other tissues—Schlapp and Bovaird.[13]

The life history of the tumor is of interest in this connection. The injury occurred in November, 1919, and was followed by only a transitory inconvenience a few days later, apparently due to muscular and joint injury rather than any damage to nerve elements. Twenty months later the first pain, evidently due to nerve change, appeared, but was only present for one or two months to be followed by complete cessation for a period of four or five months. After that there was some remission, but never complete relief, and nine months was required before evidence of cord compression appeared. If one connects the trauma with the tumor growth it is necessary to postulate a period of some months following the former before the cells lost their normal restraints and took on the characteristics of malignancy.

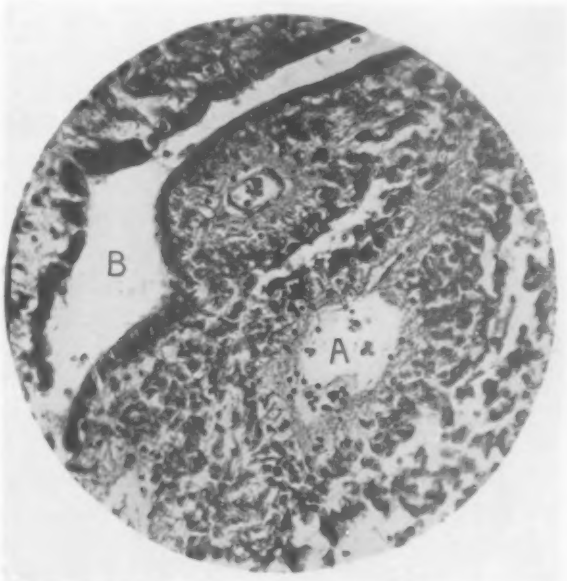

FIG. 10.—Section of a non-malignant neuro-epithelioma of the spinal cord removed after a clinical course of seven years. This tumor shows the much less cellular type of tumor with very typical rosette formation and, in addition, a cavity lined by neuro-epithelium. A—Rosette with abundant neurofibril formation. B—Cavity lined by neuro-epithelium.

The incidence of the central gliosis found on section of the cord is a matter of conjecture. Certainly no symptoms referable to this lesion were present at the time of operation, unless one assumes that the hand atrophy was so caused. The gliosis lies too far posteriorly in the cord to make this probable.

The very confused picture developing in the seven weeks between the operation and death may in some measure have depended upon the cord destruction caused by this growth. One is thus forced to the conclusion that the gliosis did not antecede the formation of the neuro-epithelioma which is a reversal of the conclusions from the study of Schlapp. It is recognized that the injury may have produced a hæmatomyelia which in turn resulted in

the gliosis. This view, however, does not seem substantiated by the facts given. A very practical question arises as to whether operative interference should have been earlier undertaken. The patient was under constant observation while the tumor was steadily increasing in size with added damage to the cord, and yet no symptom developed which was incompatable with an inflammatory lesion of the nerve roots.

Simon,[14] Dana,[15] Laroche,[16] Starr,[17] with many other writers, give ample evidence that the pain of a radiculitis or pachymeningitis may show all the characteristics that were present in this case. Frazier and Spiller[18] make this observation, "Given a case with pain of definite localization persisting without variation in its original territory for months, and especially for longer periods, one should at least have in mind the possibility of spinal tumor * * * but pain alone, even though localized for a considerable time, may be caused by radiculitis or meningo-myelitis. Pain associated with atrophy in root distribution of upper level should arouse the suspicion of tumor, and yet * * * it seems to us as a general rule advisable to defer operation until some clinical evidence of implication of the cord is obtained."

Camus[19] writes extensively on radiculitis and quotes several authors showing the difficulty of assigning a definite pathology to this lesion. He says certain primary tumors of the spinal meninges at their inception by compression of the roots produce only the symptoms referred to the roots. At this period the diagnosis most often made is radiculitis. Camus states that the posterior roots are more susceptible than the anterior and that the pathology is an inflammation of the roots themselves.

Mills and Williams[20] comment on the impossibility of differentiating the two conditions under discussion. The pain is possibly more excruciating and sharper or more lacinating in tumor cases while those of pachymeningitis often have some rigidity and soreness of the neck and aching of the shoulders. The writer (J. A. H.) has observed two cases of radiculitis or neuritis in which the pain was quite as severe as that described in this case. In both there was the same atrophy of the hand muscles and both continued uninterruptedly for a longer time than here elapsed before cord compression became apparent. Both recovered.

It seems evident that in the face of the testimony of so many observers a true diagnosis cannot be made until medullary symptoms appear. It is worthy of emphasis, however, that tumor formation in the posterior lateral region may be so closely related to the posterior nerve roots that root pain is the only symptom for considerable periods. The type of tumor here studied, because of its soft texture, its point of origin beneath the arachnoid, and its retention under this membrane, is particularly adapted to exerting the baneful pressure on the roots.

So far it seems impossible to predict the nature of these tumors in the cord or brain before operation. When found at operation they may have the most innocent appearance and be capable of rather easy removal. However, like the related tumors of the adrenal and retina, they are malignant with

a tendency to form metastases in the neighborhood and, potentially at least, distant metastases as well. It would seem to be wise, therefore, to remove them with as little disturbance of the tumor as possible and to realize that removal of any portion of them by curette or sharp dissection may be followed by recurrence of the tumor with a rapidly fatal result.

The question as to whether an earlier operation would have made recurrence less probable must be answered in the negative. At no time would removal have been accomplished with less trauma or greater certainty of removing all potential tumor element. The future must determine the final value of radiotherapy, but our present knowledge holds out at least a hope that these tumors are susceptible of destruction by radioactive agents.

REFERENCES

[1] Bruns: Die Geschsüdste des Neuru System. Berlin, 1908.

[2] Schlessinger: Tumoren des Ruckenmarks und Seiner Haube. Handbuch der Pathol Anat des Nerven System. Berlin, 1903.

[3] Joppich: Ueber ein fall von prenären Angio sarkom des Rückenmark. Universitat Griefswald, October 19, 1903.

[4] Hunt and Woolsey: Contributions to the Symptomatology and Surgical Treatment of the Spinal Cord Tumors. Annals of Surgery, 1910, Nos. 3-5-7.

[5] Inglis-Klingman and Ballin: New York Medical Journal, vol. xcii, 1910, p. 1006.

[6] Schlapp: Jr. of Nervous and Ment. Dis., vol. xxxviii, No. 3, March, 1911.

[7] Ewing: Neoplastic Diseases.

[8] Mallory: Principles of Pathologic Histology.

[9] Symmers: J.A.M.A., Feb. 1, 1913.

[10] Ewing: Neoplastic Diseases.

[11] Uyematsu: Jr. of Nerv. and Ment. Dis., vol. liii, p. 81, Feb., 1921.

[12] Wintersteiner:

[13] Schlapp and Bovaird: Journal of Nervous and Mental Diseases, vol. xxxiii, 1911.

[14] Simon: British Medical Journal, July 11, 1903, p. 71.

[15] Dana: Brachial Neuralgia and Arm Pains. Medical Record, vol. lxxi, p. 297, February 23, 1907.

[16] Laroche: Les Neuralgia du Membre Superieur Thesis. Paris, 1907.

[17] Starr: Nervous Diseases, Organic and Functional, 2nd Edition.

[18] Frazier and Spiller: Archiv. Neurol. and Psych., vol. viii, 1922, p. 455.

[19] Camus, Paul: Étude de Neuropath sur Les Radiculitis. Thesis, Paris, 1907-08.

[20] Mills and Williams: Journal of Mental and Nerv. Diseases, vol. xxxiii, 1911.

ADDITIONAL REFERENCES

Beatti, M.: Tumors of Human Nervous System (epitheliomas). Ztschr. f. Krebsfursch, vol. xix, pp. 209-214, Nov., 1922 (illus.).

Stevens, W. E.: Malignant Tumors of Suprarenal Gland. J.A.M.A., vol. lxxx, pp. 171-173, Jan. 20, 1923.

Liriassi, A.: Cervical Glioma. J.A.M.A., vol. cxxix, p. 2198, Dec. 23, 1922.

Adams, D. S.: Glioma of Lumbar Cord. Boston M. and S. Jr., vol. clxxxvi, p. 738, June 1, 1922.

Christin and Naville: Diffuse Tumors (neuroblastoma) of Ventricle Walls. Schweiz. Arch. f. Neurol. u. Psych., vol. vii, p. 49, 1920.

Gunby, P. C.: Neuroblastoma Sympathicum. A. Jr. M. Sc., vol. clx, p. 207, Aug., 1920.

Wolbach, S. B., and Morse, J. L.: Neuroblastoma Symphathicum. Report of a Case with Review of Literature. Am. J. Dis. Child, vol. xvi, p. 63, Aug., 1918.

Lehman, E. P.: Neuroblastoma with Report of a Case. J. M. Research, vol. xxxvi, p. 309, May, 1917.

Ring, G. O.: Neuro-epithelioma, Recurrent. Ophth. Rec., vol. xxvi, p. 437, Sept., 1917.

Harbitz, F.: Neuroblastoma. Arch. Int. Med., Aug., 1915.

Flexner, S.: A Peculiar Glioma (neuro-epithelioma) of the Retina. Johns Hop. Hosp. Bull., Aug., 1891, p. 115.

Morgan, J. A.: Neuro-epithelioma or Glioma of Retina. Am. Jr. Ophth., Chicago, June, 1923, vol. vi, pp. 484–487.

Mamas, J.: Nouvelles recherches sur le gliome de la rétine. Bull. de l'Assoc. franc., p. l'étude du cancer. Par., 1922, vol. xi, p. 577.

Verhoeff, F.: Glioma Retinæ. Arch. Ophth., N. Y., 1921.

Keys, M. J.: Glioma Retinæ. Brit. Jr. Ophth., 1922, vol. vi, pp. 110–118.

Berrisford, P. D.: Statistical Notes on Glioma Retinæ. Royal London Ophth. Hosp. Reports, 1916, vol. xx, part ii.

Wright, J. H.: 1910.

Verocay: Zur Kenntnis der "Neurofibrome." Beitr. z. path. Anat. u. Zur Allg. Path. 1910, vol. xlviii, p. 1. Multiple Geschwülste als Systemerkrankung am nervösen apparate. Fest. F. H. Chiari, 1908.

PRIMARY SARCOMA OF THE SPINE

By Samuel Kleinberg, M.D.
of New York, N. Y.

In dealing with destructive lesions of the spine it is usually possible, by a careful consideration of the history or close analysis of the clinical and laboratory findings, to arrive at an accurate diagnosis, or at an approximately correct conclusion as to the nature of the lesion. Recently we had on Dr. Royal Whitman's service at the New York Hospital for Ruptured and Crippled a case of what appeared to be dorsal Pott's disease. This diagnosis was borne out by every feature of the clinical examination. Following a costo-transversectomy, however, the lesion was discovered to be a sarcoma.

Fig. 1.—The 10th dorsal vertebra is reduced in size and wedge-shape. The arrow points to the site of disease.

I am prompted to report this case for several reasons. First, primary sarcoma of the spine is comparatively rare. Secondly, a review of the findings and the course of the disease lead me to emphasize some points which may prove helpful in a differential diagnosis between Pott's disease and a neoplasm of the spine. Thirdly, a costo-transversectomy afforded an experience with this rarely performed operation, the interesting details of its technic and an opportunity for direct inspection of the vertebral bodies during respiration.

Mrs. L. W., thirty-three years old, was admitted to the hospital, February 2, 1924. Four months previously she was awakened one morning by pain in the back. The backache persisted, and for the last three months she had increasing weakness in her lower limbs. On admission, she was unable to walk or stand unsupported. There was an angular deformity of the spine at the level of the tenth dorsal vertebra, marked muscle spasm, tenderness at the site of the deformity and restriction of all spinal motions. In bed she was able to move her legs. The knee jerks were exaggerated. X-ray pictures showed a destructive disease of the tenth dorsal vertebra (Fig. 1) and an abscess shadow about the ninth, tenth and eleventh dorsal vertebræ (Fig. 2). The

body of the tenth dorsal was reduced in size and wedge-shape. There was no change in the density of the bone; no mottling of the bone or lateral expansion as is seen in a compression lesion as a fracture or a carcinomatous growth. There was no lesion in any other part of her body, and laboratory tests were negative. From the clinical and X-ray findings a diagnosis of dorsal Pott's disease was made. She was placed on a convex frame with the idea of reducing the deformity and later doing a fusion operation on the spine. For a few days she did very well. The deformity was reduced and the intensity of her pain decreased. Two weeks later, after several days of unaccountable very painful distention of the abdomen, there suddenly appeared complete paralysis of both motion and sensation below the umbilicus, incontinence of urine and fæces and marked hyperæsthesia above the umbilicus. The knee jerks were present and somewhat exaggerated. Pressure sores appeared rapidly, and because of these it was impossible to apply support to either the back or the lower limbs.

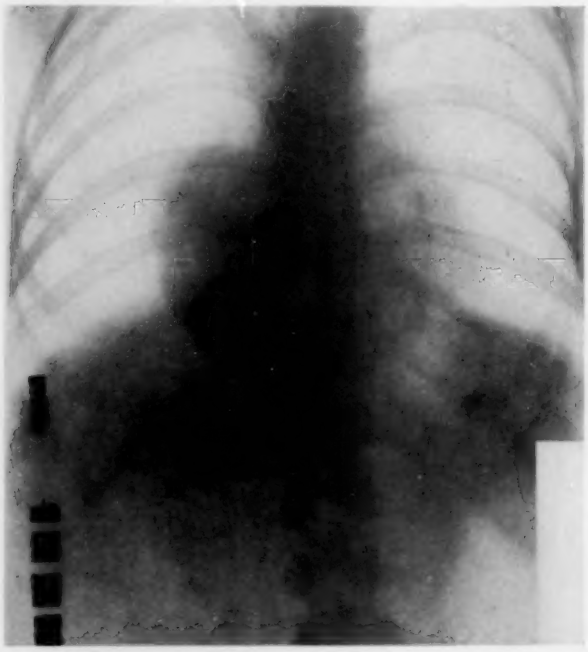

FIG. 2.—There is an irregular circular shadow of disease tissue about the 9th, 10th and 11th dorsal vertebræ. This shadow resembles very closely in location, shape and density that of a cold or tuberculous abscess.

Further investigation showed no lesion in any part of the body except the spine. There were no Bence-Jones bodies in the urine. The Wassermann test was negative. X-ray pictures showed increasing destruction of the tenth dorsal vertebra and marked enlargement of the abscess shadow. We were puzzled by the presence of the anæsthesia which is rarely found in Pott's disease. It was finally determined that the paralysis was the result of Pott's disease with the rapid formation of an abscess, which was apparently the cause of the transverse lesion of the spinal cord. As the patient was losing ground rapidly and new pressure sores appeared daily, we were threatened with a very difficult nursing problem, and saw no immediate relief from the paralysis by conservative treatment. With the patient in this pitiable and desperate condition, it was determined to evacuate the abscess by a costo-transversectomy, hoping thereby to relieve the pressure from the cord. Doctor Whitman concurred in this opinion.

A laminectomy was considered inadvisable because (1) the abscess was anterior to the body of the vertebra and could not be reached by removal of the laminæ; (2) the reports of the use of this operation for paraplegia are discouraging because of the high operative mortality, and the very low percentage of improvements in those that survive the operation; and (3) this operation would further weaken a spine that was already badly damaged. Accordingly it was decided to do a costo-transversectomy and thus reach the seat of the disease and the site of the abscess. This operation has not been done often chiefly because in most cases of paraplegia, recovery follows conservative treatment, and in the remaining number, operative intervention has but rarely been successful.

The operation of costo-transversectomy, reported a number of times in the literature, has been thoroughly described by Menard, and is called by that name in Bickham's Operative Surgery. An incision is made through the muscles, preferably to the right of the spine, at the level of the disease. The muscles are retracted so that the transverse process and the rib or ribs for two to three inches from the vertebræ are exposed. The transverse process is cut away with a rongeur or gigli saw; the vertebral extremity of the rib is removed subperiosteally. The tissues are then pushed away from the side of the vertebra until the abscess or the body of the vertebra has been reached.

The chief difficulty in this operation is one of technic and arises from the care

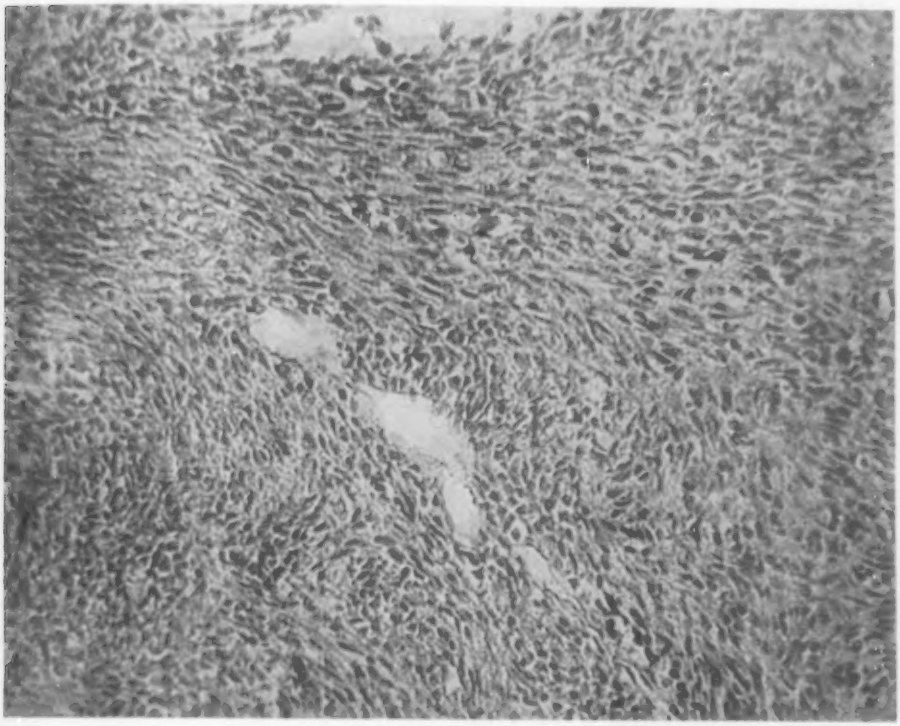

FIG. 3.—Very cellular and vascular spindle-cell sarcoma.

which is necessary to avoid puncturing the pleura and thus infecting the pleural cavity. One must also avoid injury of the spinal nerves and the structures in the posterior mediastinum.

In this case the operation was not particularly difficult. The transverse process and the vertebral extremity of the right tenth rib were gone, evidently destroyed by the disease. The soft tissues on the side of the vertebra were gray, friable and were separated and pushed forward easily by a blunt periosteal elevator. The body of the diseased vertebra was reached and the lateral and anterior surfaces exposed. It was found greatly reduced in size and bare of any ligamentous covering. The intervertebral disc was also reduced in size. While separating the tissues from the body of the vertebra there exuded about a teaspoonful of a yellow, thick granular fluid which looked like pus. I expected to see a large abscess and remove a large amount of pus, perhaps several ounces. It was a distinct disappointment, therefore, to find so little pus. I exposed the bodies of the ninth and eleventh dorsal vertebræ, hoping to find some more pus, but none was obtained. At this juncture Doctor Whitman recalled his experience in a similar case which he had operated about twenty years ago. He told

us that he could feel the motion of the vertebræ on respiration. In our case the exposure permitted us to see very clearly the movements of the vertebræ during respiration. This observation is a very strong argument in favor of fusing a diseased spine and eliminating motion which is an irritant in disease of bones or joints. Hoping that there remained an encapsulated abscess which might later rupture, an exit was provided by inserting a rubber tube to the diseased vertebra (Fig. 3). Scrapings of the tissue at the site of the disease were taken and sent to the laboratory for examination.

The patient had an uneventful recovery from the anæsthetic and apparently was somewhat relieved, because she stated when she became conscious, that she had less pain in her back and her legs felt lighter. The abdominal distention disappeared and did not return.

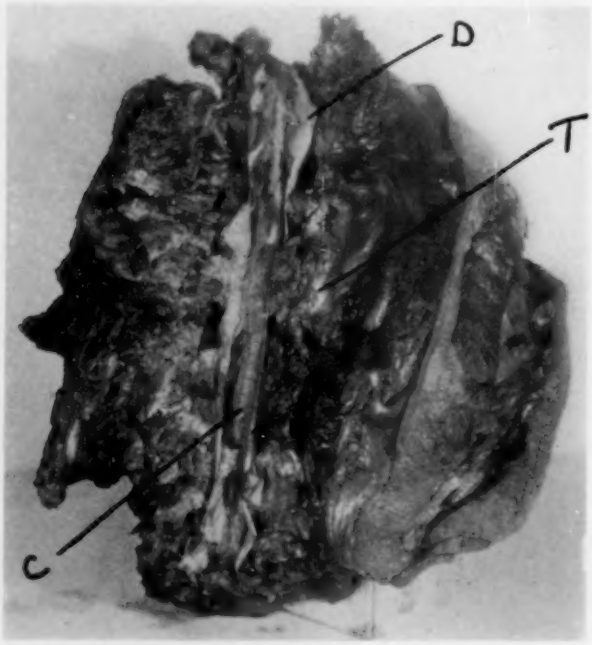

FIG. 4.—A laminectomy was performed on the removed specimen. The dura is split and the cord is exposed; C. Spinal cord; D. Dura mater; T. Tumor.

The microscopical examination of the tissue scrapings showed a very cellular and vascular spindle-cell sarcoma (Fig. 4). Search for other evidences of malignancy was in vain. The entire skeleton was X-rayed. Ophthalmoscopic and gynæcologic examinations were made. All these were negative. The condition present was a primary sarcoma of the spine.

Soon after operation a mass appeared on the right side of the spine in the region of the operative wound. The tumor grew very fast. The patient's health rapidly declined and she died of exhaustion on April 12, 1924, a little more than two months after admission to the hospital and not more than six months after the onset of the first symptom. There were no circulatory, cardiac or pulmonary complications and no evidence of metastasis. The rapid progress of the lesion was shown clearly in the radiograms. On February 6, 1924, soon after the patient was admitted to the hospital, the transverse diameter of the shadow about the diseased vertebra was 2¾ inches; on March the fifth it was 4 inches. Similarly on admission the vertical diameter of the tenth dorsal vertebra was 7/16 of an inch, while a month later it was only 2/16 of an inch.

A partial autopsy was permitted. The operative wound was enlarged and the spine from the seventh dorsal to the first lumbar inclusive was removed. In this specimen was included the tumor which was a solid elastic mass arising from the vertebræ and extending a short distance to the left and about 4 inches to the right of the spine. The tumor was 6 inches in the antero-posterior diameter, 4 inches in the transverse and 5 inches in the vertical diameter. There were several nodules or masses of tumor tissue on the mesial aspect of the middle and lower lobes of the right lung and on the upper surface of the right leaf of the diaphragm. These were evidently due to direct extensions of the tumor and not to metastasis. On the left side of the spine there was an abscess which extended to the tenth dorsal vertebra and laterally was walled off by the left lung. The parenchyma of both lungs was not affected nor was there involvement of

any of the other organs or tissues of the chest. We had no opportunity of examining the abdominal organs.

The tumor was incised. It cut very easily and apparently consisted of soft tissue only. There was very little fibrous tissue and so far as we could judge from a macroscopic appearance no bone. The cut section was grayish-red and very vascular.

We were particularly interested to know whether there was any invasion of the spinal cord by the tumor, that is, actual disease of the cord or whether the paralysis was due wholly to pressure from without. Accordingly, I did a laminectomy (Fig. 5) and lifted the tumor off carefully. I found that it was adherent to and had invaded the external fibrous layer of the dura, but had not penetrated it. The dura was split longitudinally and the cord exposed. The cord was free all around. In the region of the neoplasm for a distance of about an inch the cord was reduced in size (Fig. 6), pale and flattened. The adjacent roots were flattened and atrophied and the individual nerve bundles were abnormally distinct as if the interstitial perineural tissue was absorbed. The cord above and below this level was enlarged and on its posterior surface were numerous engorged tortuous vessels. The condition of the cord is shown very well in the natural size drawing (Fig. 6) made for me by Dr. T. Nicola. The findings described were convincing proof that the paralysis was due entirely to external pressure and not to disease of the cord.

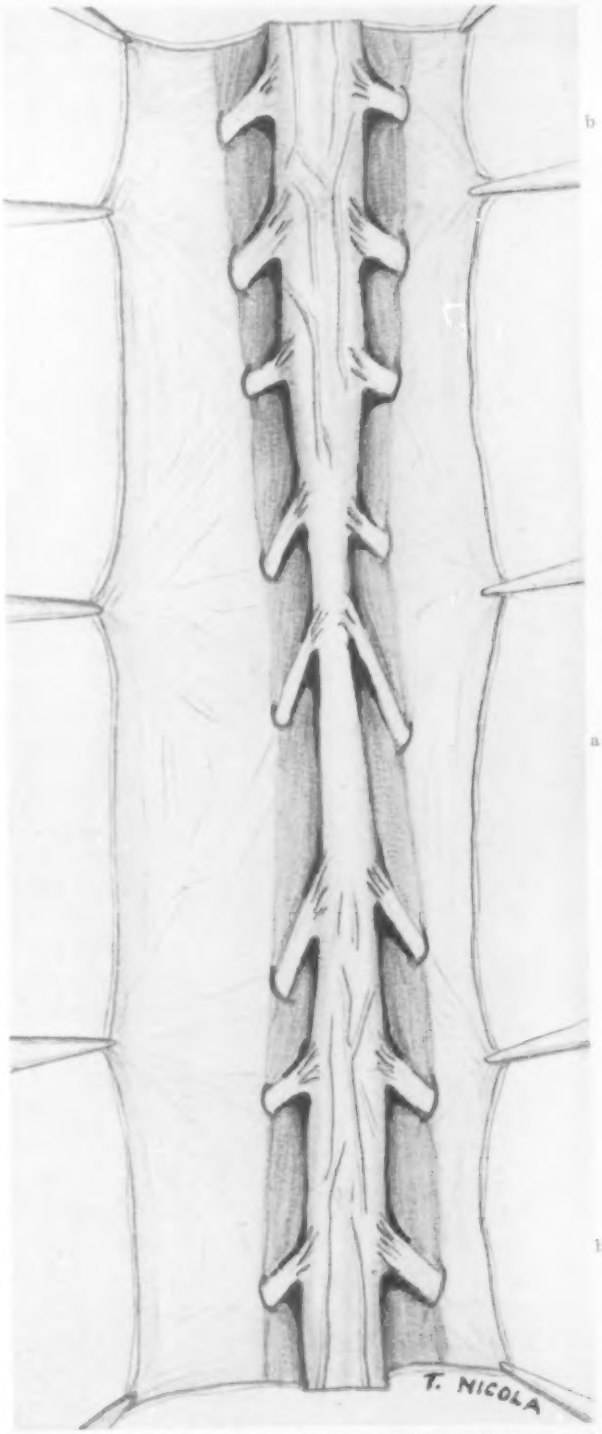

FIG. 5.—Spinal cord exposed. Natural size; a. Flattening of cord at level of the disease; b. Enlargement of the cord with distended, tortuous vessels.

The vertebræ were then sawed through in the coronal plane and the two halves are shown in the photograph (Fig. 6). The tenth dorsal was replaced entirely and the eleventh almost completely by soft, gray, granular tumor tissue.

The special interest in this case centres about the difficulty in making an accurate early diagnosis. The unusually rapid progress of the symptoms and the complete anæsthesia are, as we see now, very important differential points in favor of the diagnosis of a neoplasm. At a clinical conference of the staff of the Hospital for Ruptured and Crippled, at which this case was reported, Doctor Rugh, of Philadelphia, called our attention to the first X-ray picture (Fig. 1) in which is seen extensive destruction of the body of the tenth dorsal vertebra, but very little change in the intervertebral discs above and below it. Doctor Rugh stated that in Pott's disease the intervertebral discs in the diseased area are destroyed early, and hence when the discs are not changed much, as in this case, the lesion is not tuberculous. The unusually rapid destruction of the vertebra is in favor of the diagnosis of a neoplasm as in both tuberculosis and syphilis the destruction is characteristically slow.

FIG. 6.—This represents the two sections of the tumor and adjacent parts of the spine split vertically. Note the complete destruction of the 10th dorsal vertebra. The tumor replaces the destroyed vertebra and extends for a variable distance on either side of the spine. T is the tumor; 7D, 8D and 9D point to the 7th, 8th and 9th dorsal vertebræ.

In this case and in a number of other tumors of the spine we did not find Bence-Jones bodies in the urine. I am inclined to the opinion that when this test is negative, it does not help us any, as the case may still be one of a tumor of the bones. This leads me to the conclusion that the test has no value unless it happens to be positive.

In a similar case in the future the signs in order of importance which would incline one away from the diagnosis of Pott's disease and to that of a neoplasm are: (1) lack of destruction of the intervertebral discs; (2) rapid destruction of the vertebræ, and (3) early appearance of symptoms of a transverse cord lesion.

THE EARLY TREATMENT OF SUPERFICIAL BURNS*

By I. S. Ravdin, M.D.
and
L. K. Ferguson, M.D.
of Philadelphia, Pa.
from surgical division b, of the university of pennsylvania hospital

In September, 1923, the attention of the writers was called to the high incidence of mortality in the cases of extensive superficial burns admitted to the University Hospital. Through the kindness of Dr. Charles H. Frazier, we were given the opportunity to utilize for study a large portion of the clinical material admitted to the hospital. Before attempting detailed experimental investigation, we thought it important to study the question from a clinical standpoint, and the results of this study we are now reporting. This paper is in the nature of a preliminary report in our study of burns, and is based on a study of 15 cases.

Early in the nineteenth century, burns were classified by Boyer into three clinical types. These do not always correspond to any constant pathological picture, but they are definite enough for use.

Those of the first degree cause but a simple reddening of the skin, usually with some swelling and considerable pain. The blood-vessels of the papillary layer are dilated, and varying degrees of œdema are found, evidenced by the widened intercellular spaces in the corium and deeper layers. The pain is due in part at least to the sudden pressure caused by the œdema, compressing the delicate nerve endings situated in the papillæ.

The line between this picture and that of the second degree burn cannot be sharply drawn. Blebs of varying sizes appear rapidly or slowly according to the intensity and duration of the burning. They arise from a base of inflamed skin, and are filled with amber-colored serum which is expressed at times with some difficulty. The epiderm forming the bleb dome is white, and its cells are necrotic—their proteins coagulated. The bleb cavity is often composed of compartments, which extend upward from the enlarged papillæ. The blood-vessels are congested and a few are thrombosed. The lymphatics are dilated and the tissue spaces are wide. Ravolgi [1] has found the stratum germinativum markedly swollen, and covered by a layer of small leucocytes. As soon as the bleb is broken, the contents are discharged, drying and forming brown crusts, which are thought by some to encourage rapid epithelial proliferation. However, as soon as the bleb is evacuated, the stratum germinativum begins to slough. The inflammatory reaction diminishes the œdema becomes less, and the lower epithelial cells grow upward, become arranged in a more orderly manner, and cover the papillæ to complete the epithelial covering of the burned area without any evidence of a scar.

* Read before the Philadelphia Academy of Surgery, November 3, 1924.

A burn of the third degree implies a destruction of the whole skin layer, and usually involves the adjacent underlying tissues. The albuminous substances in the cells are coagulated, and the area becomes hard and without sensation. This coagulation of tissue proteins is best noted in burns due to boiling water and steam, because when burned by flame directly, the tissues are black and charred and without structure. The blood-vessels of the corium are destroyed or thrombosed and the tissue spaces are filled with serum loaded with broken down albuminous products. Local healing cannot begin until the dead tissue is removed or it sloughs away itself, when repair is begun by granulation and epithelization extending from the edges of the wound.

FIG. 1.

Were the local injury to the skin and underlying tissues the only indication for treatment, the problem would at once become comparatively simple. But there is much more than the local lesion which demands attention. The burned patients, especially the very old or the young, are stricken out of proportion to the severity of the local lesion. When the burn is of any extent at all, the early picture is one of shock. The patient shows a rapid weak pulse with a low blood-pressure; respiration is shallow and rapid, and the temperature is often subnormal. In a series of 186 cases of burns in children under fourteen years of age, Blumenau [2] found that 43 per cent. of the deaths occurred within the first twenty-four hours, an item which shows the severity of the early period.

After twenty-four hours follows a period of about two to four days when the clinical symptoms are those of a toxæmia. Pulse and temperature increase,

the patient becomes restless or drowsy, often vomits, and becomes irrational. In about one-fourth of the cases convulsions occur, most often in children. In some cases a scarlatiniform rash appears and the patient will run a clinical course much like scarlet fever with mild angina, albuminuria, and even desquamation. Forty-three per cent. of the deaths of Blumenau's series occurred in this period of toxæmia from the second to the fourth day.

The rapid development of such severe symptoms and consequences has led numerous investigators to attempt to explain their cause. Many theories have been advanced, but their very number is proof that none have been generally accepted. These theories may be divided into three main classes.

FIG. 2.

I. Those hypotheses which attribute the symptoms to malfunction of the skin, either to the lack of

(1) the respiratory function of the skin, causing an excessive pulmonary activity with consequent asphyxia, as believed by the early writers, or

(2) the excretory function with consequent retention of poisonous substances (Billroth)[3] and overwork of the parenchymatous organs in an effort to excrete these toxic substances by other routes.

II. Those theories which attribute the symptoms to alterations in the vascular system.

(1) Early writers feared that the blood was "driven in." This is probably an early expression of the theory advanced by Underhill and his associates, who believe a large part of the condition to be due to blood concentration.

(2) Falk [4] believed there was a dilatation of peripheral vessels with consequent rapid loss of body heat, and a general cooling of the blood.

(3) Other writers (Silberman and Salvioli [5]) tried to prove a diffuse thrombosis as the basis of this condition.

III. Those theories which attempt to explain the symptoms on the basis of an overexcitation of the nervous system.

(1) It has been thought that the whole condition is one of "shock." Then follows a period of reflex exhaustion with a loss of vascular tonus. Sonnenburg and Tachmarke.[6]

IV. Those theories which attribute the condition to changes in the blood itself. It may be

(1) a destruction of red blood corpuscles by the heat and its consequences. Max Schulze.[7]

(2) A loss of function of red blood corpuscles (V. Lesser [8] and Silberman.[9]

(3) An absorption of toxic substances into the blood. These toxines have been explained in various ways.

(a) Cotiana [10] attempted to show the formation of hydrocyanic acid in the skin of burn cases.

(b) Kijanitzin [11] believed the toxines to be due to an altered metabolism.

(c) Absorption products due to bacterial action was thought to be the cause of the toxæmia by Lustgarten.[12]

(d) More lately, it is believed that the toxines absorbed are formed by the action of heat on the tissues, especially the skin. Boyer and Gumard.[13] Robertson and Boyd.[14]

In support of this latter view are the autopsy reports of burn cases. The picture is that of a toxæmia. The work of Weiskotten [15] is the latest and most thorough on this point, and our findings agree in most respects with his. He first pointed out the fact that the "most prominent and characteristic findings were the changes in the suprarenals." These organs are found markedly swollen and deep red with marked œdema of the fat surrounding them. The cut surface shows both the cortex and medulla to be swollen and streaked with red, with some areas of homogeneous deep red. The microscopic section shows marked hyperæmia, with frequent areas of hemorrhage. The parenchyma is composed of pale-staining cells, some of which are necrotic or undergoing hydropic degeneration. Many phagocytic cells were found invading the necrotic cells. Weiskotten points out that these changes are similar to those found in the suprarenal of guinea pigs following the injection of diphtheria toxin. All the lymphatic tissue was found involved in the same process, spleen, lymph-nodes, tonsils, and the lymph follicles in the stomach and intestine. There is a necrosis at the site of the germinal centres, with an invasion of the area by large phagocytic endothelial and giant cells. The follicles of the intestine are swollen and raised, and subsequent necrosis of the superficial part of the follicle probably accounts for the ulcers which are supposed to be associated with burns.

The heart showed hyaline degeneration of the muscle fibres and an occasional area of hemorrhage, which might be found with any toxæmia. The liver and kidneys showed cloudy swelling and the other organs showed no constant changes beyond a moderate congestion. The picture then is one similar to that found associated with the severe toxæmias.

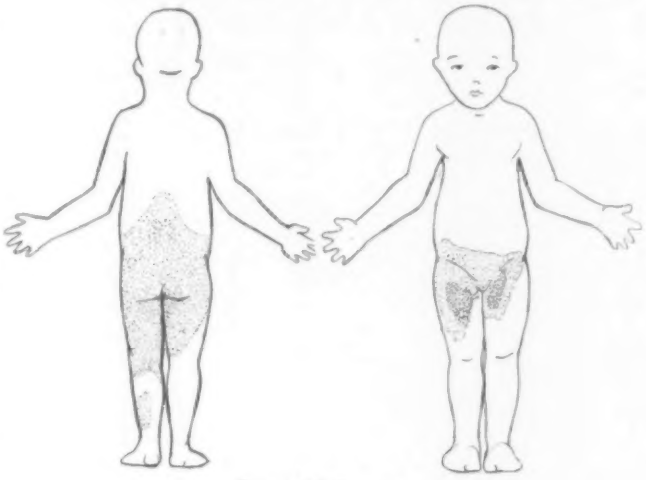

FIG. 3.—J. S., age 2.

The history of the treatment of burns is that of a series of experiments, most of which deal only with the local lesion. The early writers most frequently used compresses wet with some kind of a local antiseptic, or antiseptic ointments of various compositions. These measures were effectual in most first degree and small second degree burns, especially in adults, but in cases of severe burns where serious symptoms develop, they fail. In 1905, Sneve [16] proposed the open method of treatment for burns. He used no occlusive dressing, but allowed the burned area to "be exposed to the air." His method met with a fair measure of success, and was adopted in a modified way in our method of treatment.

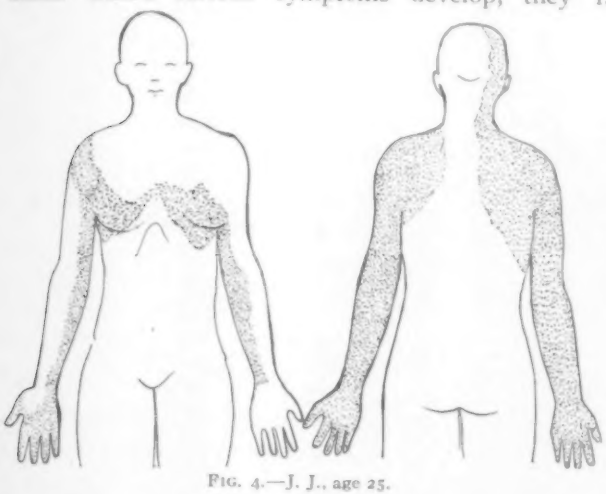

FIG. 4.—J. J., age 25.

The closed method of dealing with burns came into vogue following Sherman's [17] paper on "The Paraffin Wax or Closed Method of Treatment of Burns" in 1917. He used "a mixture of paraffin and resin (Ambrine)" devised by Barthe de Sandfordt in 1901, which he applied with an atomizer or brush after the wound had been thoroughly dried. This method is useful especially in middle-aged patients, but no effort at all is made to treat the toxæmia nor to prevent its occurrence which we believe is the most important part of the treatment.

THE PROBLEM

In considering problem, we divided our attention to following factors:

I. Primary shock:

(a) Methods for maintaining heat.

(b) Methods for relieving pain.

II. Secondary toxæmia:

(a) If due to toxic absorption:

I. Measures directly toward decreasing absorption.

1. Contract peripheral vessels to decrease early absorption.
2. Measures to locally and generally neutralize the toxin.
3. Remove cause of toxæmia—débridement.

II. Measures directed toward eliminating toxins.

1. Increase elimination by increasing body fluids.
2. If the kidneys are affected, could the gastro-intestinal tract be used as a temporary urinal by administering hypertonic salines such as magnesium sulphate which is practically non-osmotic?
3. If the toxæmia is overwhelming can we remove a massive dose of blood with its toxins and re-inject normal healthy blood—exsanguination transfusion?

III. Measures directed toward destroying toxins.

1. Since the liver is a detoxifying agent, and since its detoxifying power is proportional to its glycogen content, can we increase the detoxifying power or increase the body metabolism so as to burn the toxin and thus produce non-toxic products (carbon dioxide, water, urea, etc.) by administering a high carbohydrate diet by mouth or using intravenous glucose and insulin subcutaneously to readily burn it?
2. Can the body lytic substances be accelerated in their formation so as to be prepared to break up the toxic molecule into two non-toxic moieties as soon as the absorption begins?

(b) If due to an acidosis:

1. Could this be overcome by the administration of carbohydrates and insulin if necessary?
2. Is the administration of sodium bicarbonate necessary?

(c) If due to uræmia:

1. Is this due to kidney shutdown?
2. How can it be reduced?

(d) What part has blood concentration in these cases?

(e) Does the supposed specific effect of the toxin so affect the glandular structures as the adrenals as to cause death?

Robertson [18] and his associates at the Hospital for Sick Children in Toronto had the opportunity to treat a large number of burn cases, and in 1921, he proposed a most logical and useful method of treatment of the toxæmia. He believed as we do, that a toxin is gradually liberated from the damaged tissue and taken up by the blood stream. To combat the severe symptoms which develop, he proposed to remove the circulating toxin by exsanguination, replacing the blood volume and diluting the remaining toxin by transfusion. The method was at once radical but effectual, and we believe it to be the logical and most effectual means of dealing with cases in which toxic symptoms develop.

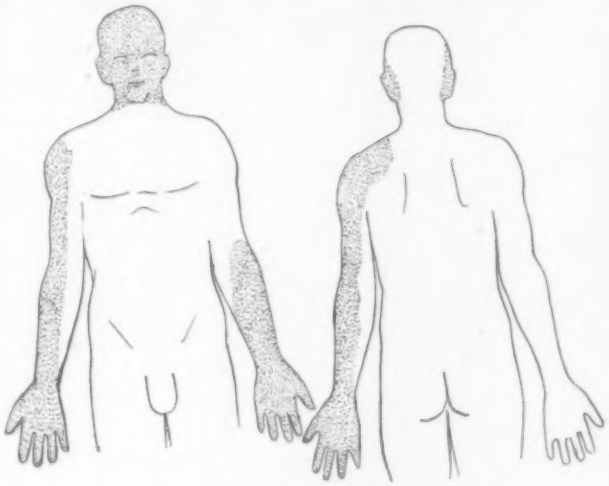

FIG. 5.—A. J., age 19.

As will be seen, the problem which we undertook to solve was a difficult one. There was no question as to the loss of body heat in the extensive burns. Peripheral vaso-dilatation is always observed as a reaction to the injurious agent. The exact degree of heat loss will depend upon the extent and degree of the burn and the degree of vaso-dilatation. Heat loss is to be feared more in the second- and third-degree burns unassociated with chars than in those in which the char forms a protective armor against heat dispersion.

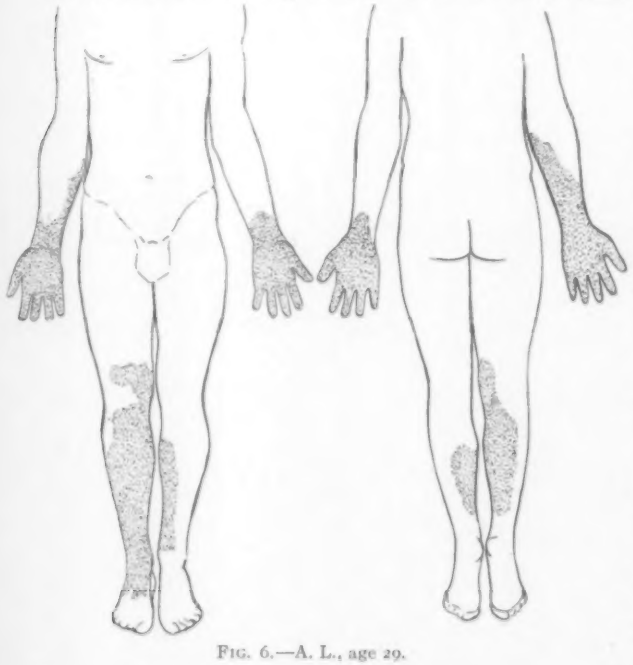

FIG. 6.—A. L., age 29.

Another unmooted point is that of pain. Pain and heat loss act in a vicious

circle to increase and prolong the initial shock. The question which arose in our minds was whether or not opiates should be utilized or whether or not the pain could not be controlled more efficiently by a local anæsthetic. We therefore resorted to the use of one-half of one per cent. novocaine packs for this relief. Meltzer some years ago expressed the opinion that local anæsthetics also had a central action and Richards has more recently expressed a similar idea. If then we can use a drug which will, acting locally, alleviate pain and acting centrally dull conscious reactions, we have all that could be desired.

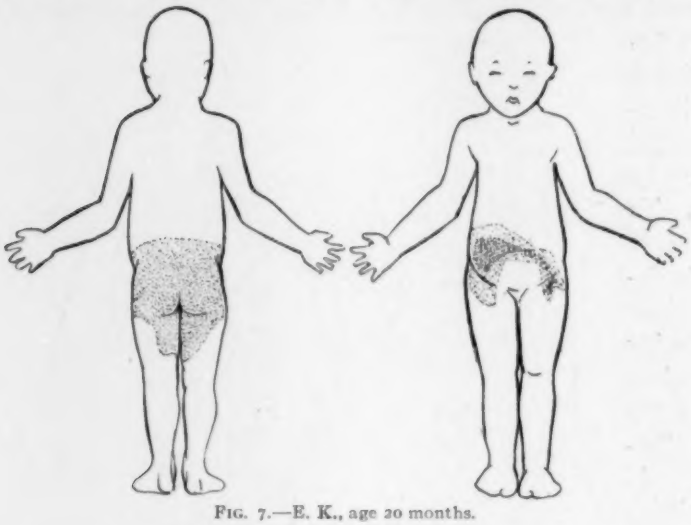

FIG. 7.—E. K., age 20 months.

Parallel with the vaso-dilatation in inflammation we find an alteration of the vascular walls. There results an increased permeability of the vessels with consequent loss of circulatory fluids, through a pouring out of fluids from the vessels.

Underhill has called our attention to the blood concentration which occurs in extensive superficial burns. This concentration is the result of the pathological exudation which accompanies the vaso-dilatation. When we began these studies the article of Douglas [19] on "Restriction of

FIG. 8.—A. C., age 29.

Rate of Flow and Interchange in the Capillaries" had not been published. It occurred to us that the toxæmia might be appreciably affected by causing vaso-constriction and circulatory block over the affected area so as to prevent a lethal or even toxic dose of the foreign protein from entering the circulatory system. The investigations being carried on by ourselves which will be reported later in the year in another paper seem to confirm those of Vogt,[20] Cevario,[21] Robertson and Boyd that the constitutional symptoms of burns, including those which cause death after the period of initial shock, but before infection occurs, are the result of absorption from the burned tissue of disintegration products which have become a foreign protein and for which the body has no normal lytic substances.

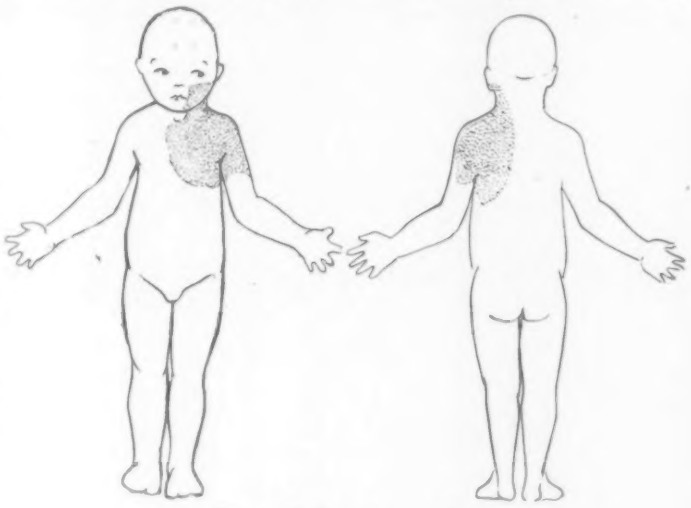

FIG. 9.—S. H., age 20 months.

Extensive superficial burns exposing large surfaces covered with a protein now foreign to the organism and which protein is rapidly absorbed because of widespread vaso-dilatation, present an interesting study of the value of vascular constriction in preventing toxæmia, the result of local absorption.

FIG. 10.—R. G., age 1.

There can be little doubt that the changing of the local surface from one in which the vessels are as porous as a Berkfeld filter to a non-receptive, non-exchanging surface is of prime importance. We believe that local circulatory block, plus early removal of the necrotic tissue, is the means of saving many lives.

We have been unable up to the present time to definitely state the type of toxin which causes the severe symptoms in these patients. Many writers are agreed that chemically the toxins give a reaction similar to that obtained from primary and secondary proteoses. We at first thought that the toxæmia was similar to uræmia, but repeated estimations of the blood urea content in children and adults suffer-

ing from very extensive burns with advanced toxæmia rarely showed a urea content of over 17 mgms. per 100 c.c. of blood. This figure is considered as a top normal. In several cases it was as high as 27 mgms. per 100 c.c., but even this figure is not high enough to account for the severity of the symptoms. We have been unable to confirm Robertson's and Boyd's findings in this respect.

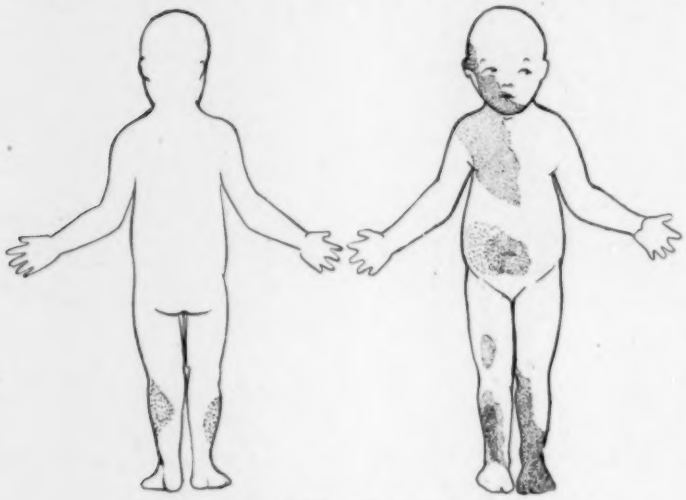

FIG. 11.—E. B., age 20 months.

Estimations of the total nitrogen content of the blood while leading us to believe that further light will come from further investigations, has not as yet been as carefully gone into as we should like to see it.

We believe that much help will come from researches carried out along the lines first suggested by Vaughan and Wheeler [22] in their studies on poisonous proteins. Vaughan found that, "the poisonous action of the cellular substance is in proportion to the extent to which, and the rapidity with which, it is split up by secretions of the body cells, and this cleavage is determined by the relative surface exposure of the substance to the action of cleavage agents."

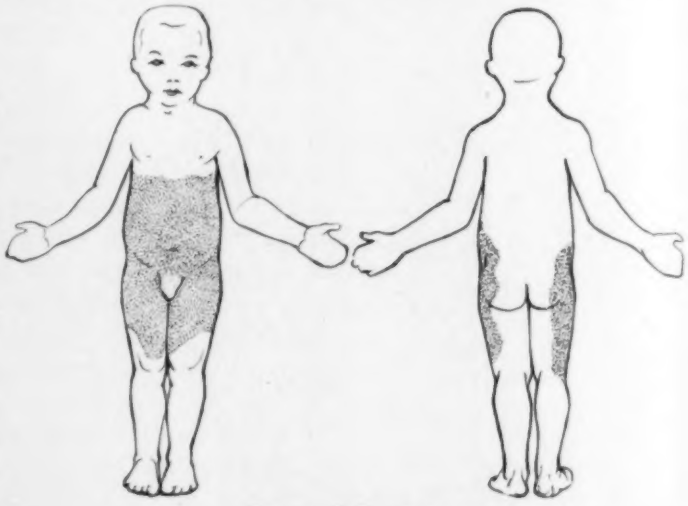

FIG. 12.—B. B., age 3.

All cellular proteins can be split into a poisonous and a non-poisonous moiety. The poisonous moiety Vaughan and Wheeler have called "the crude soluble poison," since the latter is not soluble in water while the former is. Typical toxæmia with

convulsions appears after injection of the "crude soluble toxin" in animals. It is quite possible that the convulsions so frequently reported on the third or fourth day in children suffering from extensive burns is due to this toxin. This "crude soluble toxin" is capable of autolysis into non-toxic parts. However, autolytic ferments are possessed of a definite degree of specificity. Autolysis proceeds more rapidly in a slightly acid media so that if this is desired sodium bicarbonate packs locally may retard local autolysis. Then, too, blood and blood serum have an inhibiting effect on autolytic action. This also will illustrate the disadvantage of vaso-dilatation in the burned area. The autolytic substances are probably called forth in abundance in necessity and should an overwhelming amount of the "crude soluble poison" be thrown into the organism before sufficient lytic substances have been formed to further break this down into non-toxic products, the toxæmia may be overwhelming and death result. If, however, by local block absorption it is retarded while the lytic substances are being mobilized, recovery will probably ensue, or at least the stage of toxæmia will be safely passed.

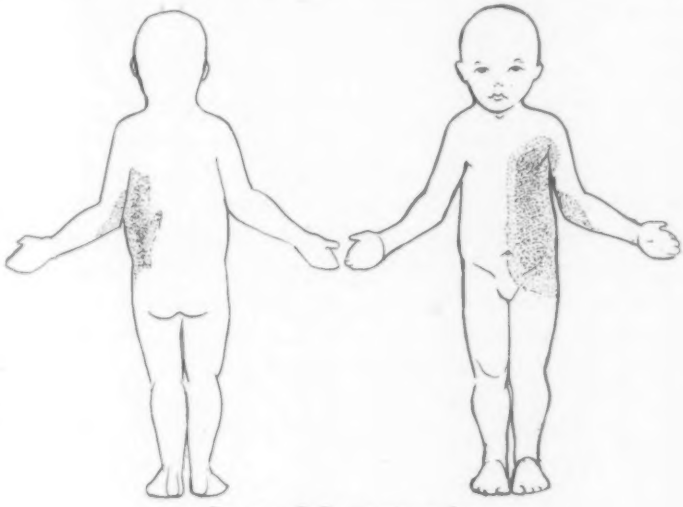

FIG. 13.—F. F., age 10 months.

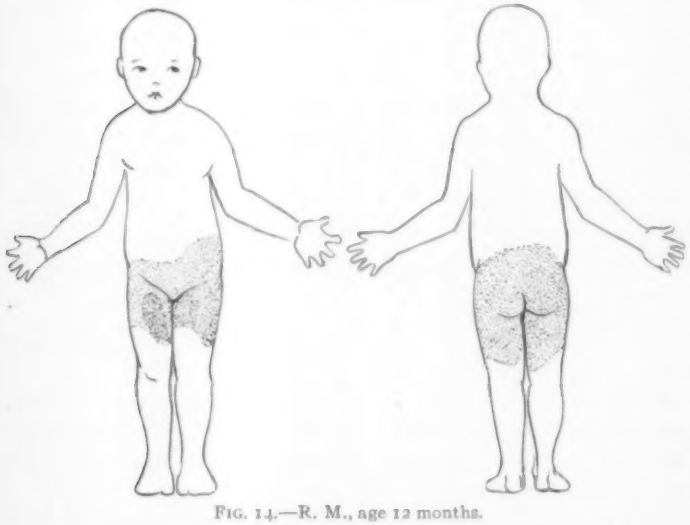

FIG. 14.—R. M., age 12 months.

It is not rational, however, to depend wholly upon the individual to take care of the foreign cellular material produced by the burn. For this reason

we believe in early débridement. There is hardly anything so spectacular as the recovery from the toxæmia which occurs after thorough removal of the destroyed tissues. The total nitrogen concentration of the fluid in the blebs is frequently increased considerably above that found in the blood. If this fluid is not removed, it must be taken care of by the patient. We consider evacuation of the blebs and removal of the necrotic skin as an important procedure. If the burn is extensive and the tissues parchment-like, the area should be débrided under general anæsthesia. This leaves a raw healthy surface which is readily available for early skin graft. The earlier this is done the less will be the reaction of the patient during the toxæmic stage. Vaccarezza,[23] in experiments on dogs, found that if the major vessels of the burned area were tied within two hours after receipt of the burn, the dogs survived. In other dogs he practised débridement with equal success. If, however, the vessels supplying the burned area were anastomosed with those of a normal dog, the dog receiving the blood from the burned area developed toxic symptoms and died while the burned dog survived.

In the measures directed toward elimination of the toxin we consider of prime importance the administration of large amounts of fluid. Underhill,[24] and his co-workers at Yale, have recently shown that extensive superficial burns cause a marked anhydremia. There is much evidence to prove that man cannot survive a concentration of the blood to 140 per cent. of the normal and that when the concentration reaches 125 per cent. conditions under which living processes are maintained are seriously jeopardized. In the extensive burns in this series the hæmoglobin rose immediately over 100 per cent. by the Sahli method. We were afraid to allow concentration to progress to such an extent as to place the patient in a bad state. When fluid escapes from the permeable capillaries over a considerable area much fluid is lost in a very short time and the larger the burn the greater and more rapid the anhydremia.

Underhill has shown experimentally, what many of us have observed clinically, that rapid and continued administration of fluids causes a gradual reduction of the blood concentration with a marked improvement in the systemic signs and symptoms. The improvement may be the result of toxin dilution, and of increased toxin elimination through the renal system. The low arterial tension seen in many of our cases may easily be accounted for by the fact that increased viscosity with a failing circulation results in the insufficient carriage of oxygen with consequent starvation of the tissues.

Lustgarten, Reiss,[25] Ajello Parascandello,[26] Peiffer,[27] and others too numerous to mention, have reported the presence of a toxin in the urine. Although they differed in their conception of the exact nature of the poison, all agreed that it was the result of protein disintegration. This important avenue of elimination should therefore be constantly kept in mind.

Although in our own cases no marked evidences of nephritis were present, this consideration is still open for further study. There can be no doubt but that the cases which come to autopsy show cloudy swelling of the kidneys. We, however, believe that the administration of large amounts of fluid will

prevent marked renal changes and reduce the probability of an associated renal inflammation severe enough to jeopardize the patient's condition.

Should, however, the patient be seen when marked renal changes have occurred, it might be possible to use large intravenous infusions and at the same time use magnesium sulphate per rectum as suggested by Fay.[28] This would be an attempt to utilize the bowel as a temporary urinal until such time as the kidneys could properly take care of the toxin elimination. Magnesium sulphate is suggested because it is practically non-dialyzable. If the toxæmia is overwhelming the method of Robertson and Boyd of exsanguination transfusion offers much promise. We have used this procedure seven times in our series. While the results are eminently satisfactory, we feel that too much reliance should not be put on mere blood replacement. It is more proper to use this in connection with débridement since then the circulating toxins and the etiological factor are both removed. We were not able to use the urea concentration of the blood as an index for exsanguination transfusion, but depended more on the signs and symptoms of the patient. In the adult the method is of lesser value since

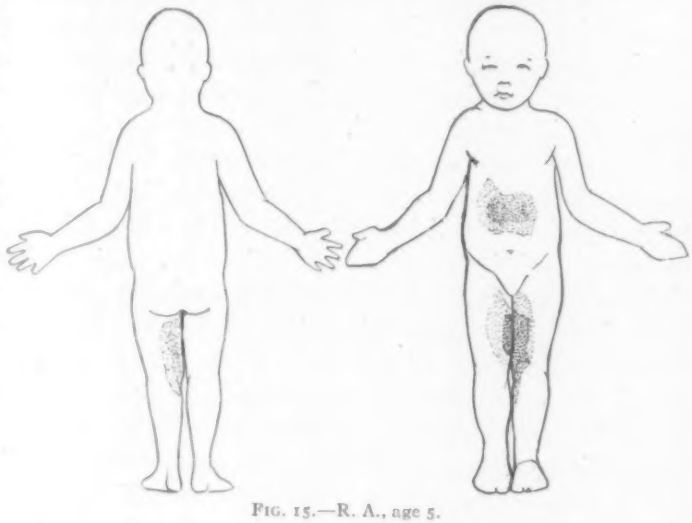

FIG. 15.—R. A., age 5.

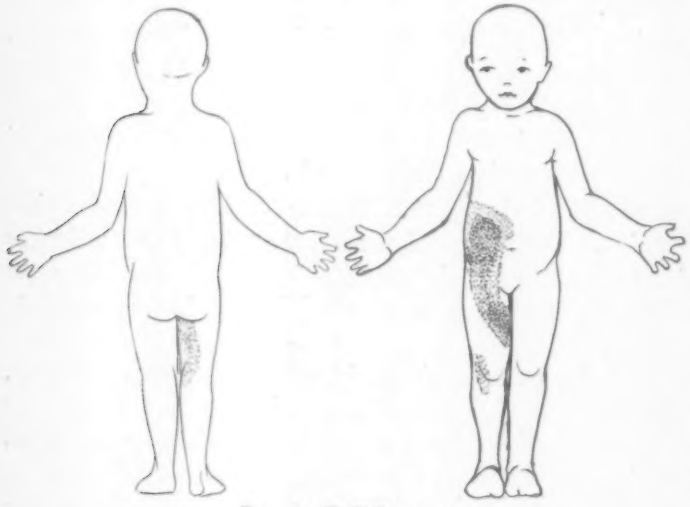

FIG. 16.—E. O'N., age 3.

replacement here is attended by considerable difficulty due to the large amount of blood necessary for replacement.

Since the liver is a powerful detoxifying agent, and since its detoxifying properties are supposedly proportional to its glycogen content, we have placed these patients upon a high carbohydrate diet as soon as possible. There is considerable doubt in our minds as yet as to the efficacy of this procedure. At any rate there is no reason for starving a patient whose basal metabolic rate is considerably increased.

We have been unable to find any method whereby the body lytic substances could be accelerated so as to more readily break up the "crude soluble toxins" except by peripheral circulatory block. If this is done for from two to four days, it is rare to see the patient die. It is during the initial forty-eight to ninety-six hours that sufficient toxins are absorbed to result fatally to the individual. After this period lytic substances are present in sufficient amounts to definitely disintegrate the toxin. We do not believe this is an antibody in the strict sense of the term and we feel that experiments along this line will be fruitless. The experimental injection of minute amounts of the burned tissue extract or of the toxic blood merely sensitizes the individual for the lethal dose. The amount of the absorption which occurs even after circulatory block is considerable and massive doses of the lytic substances are gradually formed which slowly disintegrate the toxin and are able to take care of further absorption, especially when the major portion of the burned tissue is removed.

Repeated examination of the plasma carbon-dioxide in no instance demonstrated even the slightest degree of acidosis in the most extensive burns. We, therefore, can see no indication for medication to attempt to restore an already normal hydrogen ion concentration of the blood. Persistence in the use of large doses of alkalies may result in actual alkalosis.

Neither were we able, as previously noted, to demonstrate excessive rises in the urea concentration. The toxin belongs more probably to the higher protein decomposition products such as the proteoses and peptones both of which show toxic properties when administered intravenously in large amounts.

In the section on pathology we report Weiskotten's findings at autopsy. If the adrenals show the most distinctive changes, it may be that the low blood-pressure may be a result of the faulty secretion of the internal secretion. In the cases in this series the blood-pressure quickly rose to normal after the introduction of large quantities of fluid, so that we cannot accept the suggestion that low pressure means adrenal destruction. It is more likely an index of blood concentration.

The Treatment.—The mortality of severely burned patients has been variously estimated, but carefully compiled statistics show a mortality so high that it is equalled by but few of the conditions which the surgeon is called upon to treat.

The treatment in the cases in this series has been divided into methods used at the various stages of the burn.

Patients when admitted are undressed or not, depending upon the degree of shock when received in the hospital. As soon as possible all clothing is removed and an electric cabinet is placed over the bed. Although children under it are frequently irritable for the first few hours, they quickly become accustomed to the radiant warmth and later are much upset when removed, even temporarily. The heat is kept at 100° F.

A picture of the open and closed cabinet is shown in Figs. 1 and 2. As soon as the patient is put under the cabinet, the burned area is covered with gauze saturated with a solution of one-half per cent. novocaine, which has had added to it 10 minims of 1:1000 adrenalin to each fluid ounce of novocaine. When the patient reacts from the shock, the area of the second degree burn has sufficient anæsthetization to allow one to remove the burned skin, open the blebs and remove the contained fluid with the superimposed skin without causing pain. If the burn is of the third degree, we anæsthetize the patient within twenty-four hours and do a careful débridement. Ether anæsthesia was used in the very young children, while nitrous oxide and oxygen was employed in older children and adults.

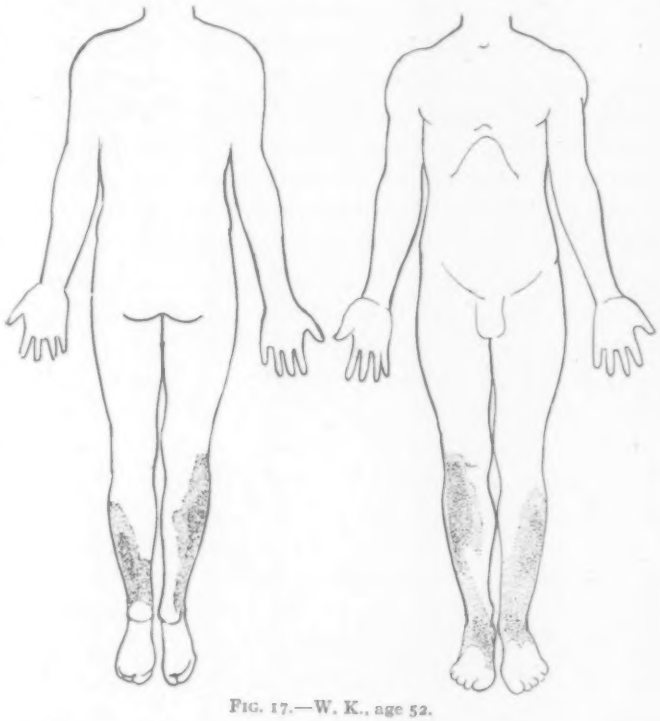

FIG. 17.—W. K., age 52.

In the majority of cases fluid was administered only by mouth, but in those cases where rapid introduction was deemed necessary, the intravenous method was utilized. We do not believe in the use of hypodermoclysis in these cases, since it is not "painless" by any method.

The novocaine packs are continued for from forty-eight to ninety-six hours, depending upon the extent of the burn and the time at which débridement was performed.

When these are removed the area is sprayed every three hours with a

fresh 2 per cent. solution of dichloramin-T. Because of the crusts which form over the area when dichloramine is utilized, it is necessary to bathe the patient daily to remove these.

In the less extensive burns we used only packs of normal saline solution and received such favorable results that we intend to use these altogether in the future instead of the dichloramine.

The diet is what we term light diet, reinforced, so as to supply as many calories as possible in an easily assimilable diet. The major caloric value should consist of carbohydrates so as to furnish available glycogen for the organism.

Should a patient be admitted after the toxæmia has developed or should symptoms of toxæmia develop in a case under treatment, we have practised exsanguination transfusion with considerable success. In the adult we have made no attempt to completely exsanguinate the patient, and in the child we have removed about 20 c.c. per pound of body weight. The blood was usually withdrawn from the median basilic vein and given through the saphenous vein. Where the signs of circulatory collapse appeared early, normal saline was given while the exsanguination was progressing.

If the burn was over a crease of a flexor surface, early extension or splinting was resorted to.

As soon as healthy granulations appeared in the extensively débrided cases skin graft was practised. We believe that better results are to be obtained from the use of Thiersch or whole thickness skin grafts than from the pinch grafts which are easily strangulated by the exuberant granulation tissue.

DISCUSSION OF CASES

Figures 3 to 17, inclusive, illustrate the area of second and third degree burns. The area of first degree burn has not been mapped out, because it might be misleading in considering the extent of the more extensive burn. The age incidence is as follows:

	Cases
1 month to 2 years	6
2 years to 5 years	3
5 years to 10 years	1
15 years to 52 years	5
Total	15

In this series, outside of an occasional trace of albumen, there were no laboratory evidences of a marked nephritis. Every specimen of urine obtainable was sent to the laboratory for examination, for we were interested in ascertaining how soon the nephritis developed after the receipt of the burn. This work showed only negative results, and we believe the factor of nephritis in burns to be greatly exaggerated.

The blood urea nitrogen estimations were made in twelve cases. In the very young individuals repeated estimations were not done, because of the difficulty of obtaining blood. In many of the cases repeated estimations were

made. The highest blood urea nitrogen was 27 mgms. per 100 c.c. and this was in a patient admitted several days following the burn. The patient at a later date after débridement showed a blood urea of 9 mgms. per 100 c.c. The remainder of the figures in all cases where the blood was examined were within normal limits.

The urea nitrogen of the bleb serum was usually higher than that of the blood. This may be accounted for by the serum containing a higher urea nitrogen than does an equal amount of whole blood. The highest estimation was 32 mgms. per 100 c.c.

Decreased alkalinity of the blood was not found to have progressed in any case as to threaten acidosis. The usual figures were within the normal limits of 55 to 60 vol. per cent. of plasma CO_2. In one case there was a beginning alkalosis which undoubtedly was due to the glucose and soda proctoclysis which was administered in the early cases.

The hæmoglobin estimated by the Sahli method was over 100 per cent. in all except two cases, and the red blood-cells were proportionally increased. The highest hæmoglobin estimation was 140 per cent.

Excision of devitalized tissue was practised in every case. In the extensive burns, as shown in Figs. 6, 8, 9, 10, 11, 12, 15, 17, anæsthesia was employed in carrying out this procedure.

The average duration in the hospital was 31.8 days.

One death occurred. This patient is illustrated in Fig. 3. His age was two years. He was in the surgical wards for twenty-seven days, during which time the burn had become epithelialized and the patient was up and about. On the twenty-fourth day he developed what apparently was a gastro-enteritis. He was seen in consultation by Dr. J. P. Crozer Griffith, who advised his removal to the Pædriatic Wards. He died eleven days later. It is probable that the burn was the etiological factor in the terminal disease or at least a contributing factor in having lowered the patient's general resistance.

BIBLIOGRAPHY

[1] Ravolgi, A.: J. A. M. A., vol. lxv, p. 291, July 24, 1915.
[2] Blumenau, N. R.: Russky Vroch., vol. xvi, p. 179, 1917.
[3] Billroth, T.: Arch. f. klin. Chir., vol. vi, p. 406, 1863.
[4] Falk: Virchow's Archiv., vol. liii, p. 27, 1871.
[5] Silberman and Savioli: Virchow's Archiv., vol. cxix, p. 488, 1896.
[6] Sonnenburg: Deutsch. Ztschrift. f. Chir., vol. ix, p. 138, 1898. Tachmarke: Deutsch. Ztschrift. f. Chir., vol. xliv, p. 346, 1896.
[7] Schulze, Max: Arch f. Anat., vol. i, p. 31, 1865.
[8] Lesser, V.: Virchow's Archiv., vol. lxxix, p. 248, 1880.
[9] Silberman: Centralblatt f. d. Med. Wissenschraft, vol. xxvii, p. 513, 1889; Tappeiner, Centralblatt f. d. Med. Wissenschraft, vol. xix, p. 385, 1881.
[10] Cotiana: Virchow's Archiv., vol. lxxxvii, p. 345, 1882.
[11] Kijanitzin: Virchow's Archiv., vol. cxxxi, p. 436, 1883.
[12] Lustgarten: Wein. klin. Wchschft., vol. iv, p. 529, 1891.
[13] Boyer and Gumard: Des Brulers—Paris, 1895.
[14] Robertson and Boyd: J. of Lab. and Clin. Med., vol. lx, p. 1, 1923. Am. Jour. Dis. of Child., vol. xxv, p. 163, 1923.

[15] Weiskotten, H. G.: J. A. M. A., vol. lxxii, p. 259, 1919. J. A. M. A., vol. lxix, p. 776, 1917.
[16] Sneve, H.: J. A. M. A., vol. xlv, p. 1, 1905.
[17] Sherman, W. O.: Surg., Gyn. and Obs., vol. xxvi, p. 450, 1918.
[18] Robertson, B.: Arch. of Surg., vol. ix, p. 1, 1924.
[19] Douglass, B.: J. A. M. A., vol. lxxxi, p. 1937, 1923.
[20] Vogt: Ztschr. f. Exper. Path. V. Therap., vol. xi, p. 191, 1912.
[21] Cevario: Sulla Pathogenesia della Morti per Ustione Pathologica, p. 13, 1921.
[22] Vaughan, V. C.: Poisonous Proteins, St. Louis, 1917.
[23] Vaccarezza, R. A.: Comptes Rendus des Siances de la Societe de Biologie, May, 1922.
[24] Underhill, *et al.:* Arch. Int. Med., vol. xxxii, p. 31, 1923.
[25] Reiss: Arch. f. Exper. Path. U. Pharm., vol. xi, p. 18, 1904.
[26] Ajello and Parascandello: Wein. med. Wchnschr., No. 14, vol. xv, p. 16, 1904.
[27] Peiffer: Virchow's Archiv., vol. clxxx, p. 367, 1904.
[28] Fay, T.: J. A. M. A., vol. lxxxii, p. 766, 1924.

LIGATION OF THE ABDOMINAL AORTA*

REPORT OF THE ULTIMATE RESULT, ONE YEAR, FIVE MONTHS AND NINE DAYS AFTER LIGATION OF THE ABDOMINAL AORTA FOR ANEURISM AT THE BIFURCATION

By Rudolph Matas, M.D.

of New Orleans, La.

PROFESSOR OF SURGERY IN TULANE UNIVERSITY

Synopsis.—Death caused by a fulminating pulmonary hemorrhage from a tubercular cavity developed in the course of an acute generalized tuberculosis. The aortic aneurism almost completely obliterated by dense clot. The process of cure had been practically effected at the time of the fatal pulmonary hemorrhage.

A bilateral aneurism had rapidly developed in both common iliac arteries, including the bifurcation of the abdominal aorta in a young syphilitic negress, aged twenty-eight years. The bisaccular tumor projected from the promontory of the sacrum, pulsating vigorously in the hypogastrium up to the umbilical level and completely filling the true pelvis. Ligation of the abdominal aorta (April 9, 1923) immediately above the sac, with completely occluding half-inch cotton tape ligatures in juxtaposition (one above the other). Immediate total arrest of all pulsation and circulation in the sac and of the femoral and pedal pulses in both lower limbs. Return of pulsation and aneurismal bruit in the sac, with coincident pulsation in the femoral arteries at the groin, on the ninth day. In the course of a year, a gradual but progressive reduction in the size of the sac, with cessation of pulsation and of the aneurismal bruit, followed by progressive hardening of the right (larger) sac, and almost total obliteration of the right femoral pulse; the left sac still pulsating vigorously, but much harder and reduced in size. Left femoral pulse still felt, but beating feebly at the groin. No pedal pulses on either side. General improvement in the patient's condition under the influence of rest and specific medication, in spite of a series of complications which, at various times, threatened the life of the patient (bilateral lobular pneumonia; albuminuria; suppurative osteoperiostitis of the left greater trochanteric region, requiring incision and drainage of a large abscess; compression neuritis of the anterior crural nerve and branches, with consecutive contracture—flexion—of right leg.) No sloughs, no decubitus eschars or trophic ulcers visible anywhere. The left lower limb preserving its nutrition, normal appearance and function, without disability in sensation or locomotion. Only a

* The clinical history and detailed description of the operation, with a summary of the post-operative record and discussion of the possible explanations of the early restoration of the aneurismal and peripheral circulation in this case, were made the subject of a preliminary report submitted in abstract, to the American Surgical Association at its meeting in Baltimore on April 18, 1924.

stiff and contractured right leg, with hyperæsthesia and hard œdema of the foot remaining to testify to a neuro-paralytic and ischæmic process which had been initiated in this extremity before the ligation of the aorta. The patient gaining in weight and strength, one year and eight days after the ligation of the abdominal aorta.

Post-operative History.—As stated in the preceding synopsis, the patient was gaining weight and strength and was able to walk about on crutches or to roll about the hospital in an invalid chair up to April 18, 1924, when the preliminary report of the case was made to the American Surgical Association.

In this report, the clinical history and detailed description of the operation was supplemented by the post-operative record, illustrated by photographs of the patient, drawings, radiographs and charts, covering the whole period of twelve months and eight days following the ligation of the abdominal aorta. In the author's commentaries and discussions of the post-operative history, the theories that would account for the early return of pulsation in the aneurismal sac and in the femoral vessels were especially considered. The pulsation in the sac had returned originally on the ninth day after the ligation and with this return of pulsation and reappearance of the femoral pulses, the rapid pulse and respiration that had characterized the first two weeks after the ligation, gradually subsided from a pulse rate of 160, on the first day, to 96 on the twenty-first day. The general blood-pressure taken in the arm fell with the ligation from $\frac{118}{90}$ to $\frac{100}{75}$. The blood-pressure, shortly after the ligation, was $\frac{114}{72}$, but gradually fell in the next few days to $\frac{80}{60}$, and continued low for months during the whole summer. It was not until November, 1923, when the patient's strength had returned and the heart shadows, as shown by the radiographs, had enlarged, that the blood-pressure rose to $\frac{112}{70}$ and continued stabilized at about this rate up to the time of the report to the Association, in April, 1924.

The embarrassment of the pulmonary circulation following the immediate rise in the aortic tension after the ligation is also shown by the increase in the respiratory rate from 26 to 40 and 50 until April 27, when the respirations dropped gradually to 26. It is really surprising that the myocardium, enfeebled by a protracted and most virulent syphilitic infection, a generalized polyarthritis of the spine, hip and knee-joint, accompanied by a constant high fever for months, should have survived the continued strain of the aortic and pulmonary obstruction imposed upon the heart by the total occlusion of the abdominal aorta.

While the cardiopulmonary disturbances noted in this case can be easily accounted for by the strain upon the heart, and the improvement which gradually followed the reëstablishment of the aneurismal circulation, with return of pulsation and bruit in the sac as early as the ninth day, is also explained by the relief in the aortic tension, the fact remains that the periph-

eral circulation in the extremities was well maintained in spite of the absence of all the distal pulses in the lower extremities during the *nine days* that the aneurism was pulseless and completely stilled.

But why did the pulsation return in the aneurism on the ninth day after the unquestionably total occlusion of the aorta? That is the question.

In this case, the aorta was ligated immediately above the sac on the proximal (cardiac) side of the aneurism, the two tape ligatures actually encroaching upon the dilated cone formed by the artery as it merged into the aneurismal sac.

The impending rupture of the secondary sac, which had formed in the retroperitoneum as the consequence of a large leak which had occurred some time previously, made it necessary to tie the aorta completely, not partially. That this was done effectively is shown by the collapse of the sac and the complete arrest of the femoral and all the peripheral pulses. However, in spite of this, the lower limbs to the toes retained their warmth throughout and never showed the waxy, cadaveric pallor of total anæmia. Evidently blood found its way to the extremities through collateral channels, even immediately after the aortic stream had been blocked by the ligature.

To account for the relapse in the aneurism, three theories were considered. First, that, in spite of the double ligature and the care taken to prevent the knots from slipping by transfixing them with through-and-through silk sutures, it was possible that the texture of the material (one-half inch cotton tape for both ligatures) had stretched under the constant pounding of the systolic wave and the softening effect of the tissue juices without the yielding of the knots. If this had occurred, the early return of pulsation would be easily explained by the reëstablishment of the aortic channel sufficiently to allow a small, reduced stream to force its way from the aorta into the sac. While this would seem scarcely probable with tape bands tightened with sufficient force to crush the arterial walls, it was nonetheless conceivable that the fabric made of cotton fibre could have stretched sufficiently to allow a small stream to go through.

The second theory was, that the aortic wall had been cut through in some part of its circumference, thus permitting the formation of an extramural passage between the newly formed capsule of organized exudate and the ligatures, thus restoring the continuity of the aortic blood stream, through a newly created passage. This was not probable, as a fatal hemorrhage or pulsating hæmatoma would seem unavoidable.

The third explanation that suggested itself was that the collateral circulation, which had developed in consequence of the obstacle created by a large leaking aneurism, was not only able to reëstablish the peripheral circulation, but to find its way back into the sac by retrograde paths; the large anastomotic branches of the internal and external iliac, lumbar, iliolumbar, with the circumflex iliac, sacral, gluteal, inferior hemorrhoidal, deep epigastric, etc.

Of these explanations, the first and third seemed the most plausible in accounting for the return of the pulsations in the sac and in the extremities.

As the subsequent history has shown, the first of these theories proved to be correct, with the third as a contributing element, especially in accounting for the preservation of the circulation in the lower limbs during the first nine days after the ligation when all the aneurismal signs and the peripheral pulses were suppressed.

On my return to New Orleans from the meeting on April 20, I found that the patient had developed a slight evening fever which was first accounted for by the presence of a group of enlarged lymph-nodes in the left submaxillary triangle. At first we were inclined to attribute these to an oral infection originating in a carious tooth on the corresponding side. On April 28, 1924, the glands were removed by a block dissection, which completely emptied the submaxillary triangle. Coincidently the carious teeth were extracted. The gross and microscopic examination of the gland tissue showed unmistakable foci of caseous degeneration and typical tubercular infiltration. A careful examination was made of the abdomen on this occasion and the following observations were recorded on the operative sheet. "The original aneurismal tumor, for which the aorta had been ligated on April 11, 1923, has contracted enormously, diminishing fully 60 per cent. of its original size, and the pulsations have disappeared over a corresponding area. A spherical mass, however, still pulsates on the brim of the pelvis, apparently a little below the promontory of the sacrum and over the left sacro-iliac joint. This mass pulsates, but much less vigorously than after the beginning of the relapse. Its anatomical position suggests that it is a relic of the aneurism corresponding to the left common iliac. The general expansile pulsation has certainly diminished very perceptibly, even in this circumscribed area. "The patient has been practically free from the subjective symptoms caused by the aneurism in the last two months. No pains in the pelvis, or radiating pains down the lower limbs. Apparently the tumor is undergoing progressive obliteration by gradual deposition of clot."

After the submaxillary adenectomy, the patient improved as the temperature diminished; but in June the fever returned and, with it, another chain of glands appeared in the left cervical region, which spread rapidly along the superior and inferior cervical triangles. On July 1, 1924, under local and regional anæsthesia (novocain-adrenalin) a long chain of densely infiltrated lymph-glands was removed in block by a very extensive dissection. All the glands showed a very advanced stage of tuberculous degeneration. The extent of the disease, following as it did the sheath of the carotid and the internal jugular into the anterior mediastinum, and the rapidity with which the infiltration had spread, made us fear that the deeper mediastinal groups were also involved.

Following the extensive adenectomy, the patient developed a high, continued remittent fever, which could not be explained by the condition of the wound. This was reopened for inspection, with negative results as far as any infection was apparent. The fever continued with remissions between 101° and 104°, with cough and expectoration and all the signs of bilateral

pulmonary consolidation. On July 31, the sputum showed tubercle bacilli and subsequent examinations confirmed the diagnosis of acute pulmonary tuberculosis, with rapid breakdown of the lungs and formation of cavities. From this on, the patient grew weaker, losing weight steadily. The blood-pressure fell progressively. Towards the end of July, the fever abated, but continued with evening rises to 101° to 102°, followed by profuse sweats. The pulmonary signs of softening with cavity formation, cough and muco-purulent expectoration, increased with extraordinary rapidity. On August 6, the patient's weight had dropped to 99½ pounds; blood-pressure 90/60.

In spite of all this, she insisted upon sitting up in a rolling chair. On September 3, she was transferred to the Tuberculosis Pavilion of the hospital. There she remained, constantly in bed, though cheerful and hopeful but getting thinner and weaker every day.

On Monday, September 10, 1924, at about 10 A.M., she was seized with a violent cough, which was accompanied by a great gush of blood. She died in a few minutes—before the ward nurses or attendants could scarcely reach her side.

Preservation and Röntgenological Examination of the Cadaver Before Autopsy.—Immediately after death, at 10.30 A.M., September 10, 1924, the body was transferred to the morgue of the hospital and kept in cold storage for eight hours. Marked cadaveric rigidity had occurred. The arterial system was then injected with commercial (undertaker's) embalming fluid, consisting essentially of a dilution of formalin in alcohol.

The fluid had been tested and compared with other preservative fluids to determine its relative translucency to the X-rays. Three standard solutions used in the laboratory of the medical school of Tulane University were examined radiologically and all were found translucent to the rays, but the fluid selected was particularly clear and shadowless in the radiographs of the three test tubes subjected to examination in the X-ray laboratory of the hospital. The embalming fluid was injected through the brachial arteries, and it was noted that it reached every part of the body, proving that there was no serious impediment to the circulation even in the extreme periphery of the lower extremities including the feet and toes.

The next day, September 12, the arterial system was again injected—this time, with an opaque aqueous dilution of bismuth magma, which was allowed to flow by gravity into the ascending aorta, care being taken not to force the injection for fear of rupturing the aneurism and causing extravasations that would obscure the view of the great arteries and their collateral branches, which it was our purpose to study in the radiographs before attempting their anatomical dissection. With the invaluable coöperation of Doctor Granger and the Staff of the X-ray Laboratory of the Charity Hospital, a series of radiographs—including the head, neck, thorax, abdomen, and the extremities—was then made. The results obtained by these radiographs were very instructive and remarkable in many ways. They showed clearly (1) that the main arteries of the lower extremities (iliacs, femorals, tibials) were pervious to their terminations; (2) that the opaque fluid entered the aneurismal sac *directly* through the aorta, and that this found its way to the lower extremities by way of the common, external and internal iliacs, but chiefly through the left common iliac and its branches—the right common iliac having been obliterated in the sac; (3) the radiographs showed that the opaque fluid injected through the aorta had penetrated all parts of the arterial system, and proved that by this method a view of the arterial circulation could be obtained, which was far more detailed than by an actual anatomical dissection.

Unfortunately the charting and tracing of the collaterals of the deep aortic branches were obscured by the overlying shadows of the visceral vessels which were injected in great profusion, forming dense plexuses of minute and nameless vessels. This was particularly noticeable in the lungs, coronary circle of the heart, abdominal and pelvic viscera and in the brain. This obscuring effect could have been avoided by the removal of the viscera after the opaque injection, and by other modifications of the technic which were not thought of or appreciated at the time. The crude results obtained by the imperfect application of the röntgenologic method in this case—probably the first in which it has been applied long after the surgical ligation of the aorta in the living human subject—fully confirms the experimental studies of Katzenstein (1905), Offergeld (1907), Mangin (1910), Bolognesi (1919), Orrin (1920), and more especially of Leriche and his Lyonese associates (1922), and attests the immense value of the radiologic method in the study of the collateral circulation after the occlusion of the great surgical arteries.

Autopsy and Conclusions.—On September 13, the third day after death, a systematic autopsy was performed, which was followed by a special dissection of the aorta and its branches, and of the aneurismal sac in all its anatomical relations. Photographs of all the involved parts were taken seriatim as they were clearly exposed. The conclusions arrived at were:

1. That death had been caused by pulmonary hemorrhage. The bleeding had followed the erosion of a large vessel in the walls of a tubercular cavity in the middle and lower lobes of the left lung which communicated with a large bronchus. Both lungs were densely infiltrated with tubercular deposits, which completely consolidated the whole left lung and the base and posterior half of the right lung. The tubercular mass in the left lung had broken down and formed a series of cavities which honeycombed the centre of the left lung where the hemorrhage had occurred. The pleural cavities were obliterated by dense adhesions.

2. The posterior mediastinal lymph-nodes and along the thoracic duct, from the neck to the diaphragm, and the retroperitoneal and mesenteric nodes were infiltrated and enlarged by recent tubercular deposits, which testified to the acuteness and wide range of this infection.

3. *Abdominal and Pelvic Conditions.*—The aneurismal sac formed a prominent hard mass, which bulged as large as an adult fist in the midline overlapping the bifurcation of the aorta. It was evident that the sac had begun to leak a long time before the ligation of the abdominal aorta. The extravasations had formed a number of large diverticula which extended laterally far into the right and, less, into the left iliac fossæ, and downwards into the hollow of the sacrum as low as the third sacral vertebra. The body of the last lumbar vertebra and anterior surface of the sacrum had been eroded and denuded of periosteum but were now covered with a layer of firm laminated clot. The right ilio-psoas muscle had been completely disintegrated, and the sac wall was formed by the iliac fascia. The primitive sac had formed at the exact level of the bifurcation involving the origin of both common iliacs. It had ruptured at a very early stage of its formation, the original sac, which was well defined, probably not attaining the size of a small hen egg when it began to leak. Therefore the bulk of the large sac recognized in life and revealed in the cadaver, was formed by a number of secondary sacs or diverticula which encapsulated the extravasations as they spread in lines of least resistance under the iliac fascia, and the retroperitoneum of the sacral hollow. The secondary sacs were filled with dense clot, which was laminated for the greater part and was so densely adherent to the bone and sac walls, that it had to be scrubbed vigorously to detach it. It had evidently formed and hardened before it had felt the coagulating and hardening effect of the formalinized embalming fluid. The clot weighed, when removed from the sac, a little over 300 grams.

4. On investigating the relations of the aorta to the sac at the seat of the ligation, this was recognized only by a spindle of dense fibrous tissue which completely enveloped the aorta immediately above the fusion of the artery into the sac. The two, one-half

inch woven cotton tapes, which had been used to ligate the aorta, were concealed from view by the encapsulating mass of fibrous tissue and organized exudates in which they were imbedded. They had not ruptured the intima, and were not in the least visible in the lumen of the aorta. The only indication or sign of their presence was a circular elevation or diaphragm formed by the inner wall of the artery where the aorta had been occluded. In the centre of this diaphragm, which was smooth and perfectly covered by the endothelium of the intima, and free from clot, there was a small narrow opening, visible from the cardiac side, which allowed the tip of a uterine probe to pass through the orifice with some friction. This opening was about 8 millimetres in circumference (judging by the calibre of the probe), and it was through this small opening that a stream of blood had found its way directly into the aneurismal sac, with sufficient force and volume to feed the sac and to nourish the peripheral parts.

On completely dividing the aortic walls through this diaphragm, the two tape ligatures were found at the level of the constriction. They had diminished considerably in bulk, but were perfect in their continuity. The knots, which had been transfixed with silk sutures to prevent slipping, had not yielded in any way. It was evident, however, that the tapes had relaxed as they softened under the combined effect of the tissue juices and the infiltration of the fabric with invading tissue cells. In this way a total occlusion was gradually transformed into a narrow stricture, thus accounting for the return of the aneurismal pulsation and the relief of the cardio-pulmonary symptoms, which had caused so much anxiety during the first nine days following the ligation.

REMARKS

The fact that the circulation in the lower extremities had been well maintained during the period of total occlusion (nine days), shows that the collateral circulation had developed sufficiently before the ligation to insure the vitality of the lower limbs, though not enough to prevent an undue and almost fatal strain upon the heart. The great improvement in all subjective symptoms and in the objective signs of the aneurism (progressive reduction in the size of the aneurism, increasing hardness, contraction of the pulsating area, diminution in the extent and intensity of the aneurismal bruits) which were most noticeable towards the end of the patient's life, as the blood-pressure fell with the advancing tubercular infection,—strongly suggest that a complete consolidation and cure of the aneurism was about to be effected, when the patient's life was cut short by the overwhelming tubercular infection and fulminating pulmonary hemorrhage—one year, five months and nine days after the ligation.

The clinical evidence to this effect was fully confirmed by the post-mortem findings which showed that the sac has filled with firm laminated clot and that the aortic blood stream reached the lower extremities only through an open channel in the sac that led to the left common iliac—the right common iliac having been obliterated in the walls of the sac.

In conclusion, this observation shows that even though a primary total (atresic) occlusion of the abdominal aorta, through the relaxation of the ligature material gradually becomes a *partial* (stenotic) occlusion, the much reduced circulation in the sac which follows this relaxation is not necessarily prohibitive of cure, but may in reality prove of advantage in favoring a more gradual but firmer consolidation of the clot. Furthermore, the gradual yielding of the ligature material in weak exhausted patients with feeble

hearts, ill prepared to stand the enormous strain of a total aortic occlusion, as was notably the case with this patient, may save a heart that would otherwise have failed if a more unyielding material had been used for the ligation. Again, the facts revealed by the anatomical and histological study of the aorta at the seat of the ligature conclusively prove that tape ligatures, made of cotton fabric, when applied with sufficient force to completely occlude the lumen of the aorta, remain encysted in the walls of the artery and are perfectly tolerated by the tissues. In this case, the tapes remained imbedded in the aortic walls as a constricting ring for over seventeen months without causing the slightest necrotic or degenerative changes in the intima. In fact, the vessel walls were strengthened by the dense capsule of organized exudates and fibrous tissue of new formation in which the tapes were imbedded. In view of the perfect tolerance of this material by the blood-vessel wall, it would seem superfluous to resort to strips of fascia or of aorta or other less readily available or dependable (shorter lived) material, for the purpose of occluding a large artery of the calibre of the aorta. On the other hand, ligatures made of more rigid or unyielding material (metallic bands) which will maintain a complete atresic occlusion of the aortic lumen are more likely to cause premature ulceration, atrophic, or necrotic changes in the arterial wall which may end in disastrous hemorrhages. For this reason the writer still holds to cotton or silk tape as the safest and most practical material for the ligation of the aorta and its great primary branches (innominate, left carotid, left subclavian, common iliacs, at their origin), as first taught by the late Professor Halsted in the latter part of his career.

A final report of this case in all its bearings, including the radiographs, photographs, microphotographs and drawings, showing the histology of the aorta at the seat of ligation, is in course of preparation and will appear in a later publication.

CONGENITAL ARTERIOVENOUS FISTULA OF LEFT BRACHIAL ARTERY AND VEIN WITH SECONDARY ARTERIAL BLOOD SUPPLY TO THE ARM

By Bertram M. Bernheim, M.D.

of Baltimore, Md.

The case here reported presents so many unusual and interesting features that a detailed review seems justified. Not that an arteriovenous aneurism in itself is so very rare or so especially interesting, but that the manner of occurrence of the one under consideration, its development, its treatment and the final denouement are so unusual. I have only seen one other congenital fistula and that * was really an arteriovenous affair in effect only, since the vessels did not actually open one into the other, but were found at operation to be connected by several (six) short but nonetheless definite little veins, the individual ligation of which cured the condition.

Ordinarily, a stab wound, bullet wound, or some form of penetrating wound is at the bottom of these blood-vessel unions. In the present instance nothing of this sort had happened and the most careful questioning and painstaking studies, including repeated X-rays, failed to reveal a possible cause.

History.—The patient, Mr. F. C., age forty-seven, married, no children, came to me complaining of a condition of his left arm that had been noticeable since he was sixteen years old. It may have been there before that, because he recalled that his mother had always told him to be careful of his left arm. It did not bother him, though, till he was about sixteen, and even then he was not seriously inconvenienced. He only noticed that there was a little red spot on the inner side of his wrist which was about the "size of a nickel and stuck out like small grapes." It used to hurt him and he would get relief by picking it till it bled. After it had bled awhile the pain ceased. There seems never to have been any trouble in stopping the bleeding.

The patient says he worked in a steel rolling mill plant at about the age of sixteen, and I suggested that possibly a small bit of steel might have flown off a wheel or piece of metal and lodged in his arm without his knowing it. He said this did not occur and could not have done so, and certainly there was no scar anywhere to be found and X-rays failed to demonstrate any foreign body.

From the time the patient first noticed the grape-like swelling, his left arm seems gradually to have increased in size and weight as compared to his right. In fact, the weight of the arm has always been annoying, but he went along his way doing much as other young men did and gave little heed to the condition. That the true nature of the trouble was suspected years ago is evidenced by the fact that the patient always had the impression that nothing could be done about the arm and that it had best be left alone. He thinks his mother gave him this impression. Whether it was for this reason, whether the arm really did not bother him much, whether he was afraid, or whether he was just too blunt to realize his increasing danger, certain it is that he had nothing done. More than likely he had had the thing so long that he had become used to it. He even went on the stage and for some years was a dancer of parts, finally giving this up to go into business.

* Renhoff, W. F.: Congenital Arteriovenous Fistula. J. A. M. A., Sept. 6, 1924, vol. lxxxiii, No. 10.

Upon occasion, though, the arm did give him real concern in that latterly it got to be quite sizable, rather more difficult to handle, and if he bumped it or if it was knocked, considerable pain resulted, and if the bump was severe, the pain lasted for hours and even days. Then, too, he began to notice an increasing loss of sensation in his fingers and thumb and they gradually became rather useless, especially the thumb and first two fingers.

It took an accident to bring this man to a surgeon—or the pain that resulted from an accident. He fell against a chair in July, 1924, giving his left forearm a severe bump. The skin was not broken, but the arm got quite red, swelled up more than ever, and became very painful. His physician thought he had broken the bone, but X-ray failed to show this. Rest, compresses, etc., failed to give much relief, but after a few weeks the pain gradually eased. It never entirely disappeared, though, and upon the slightest provocation returned with renewed violence. Further medical advice was had, whereupon the real cause of the pain was ascertained.

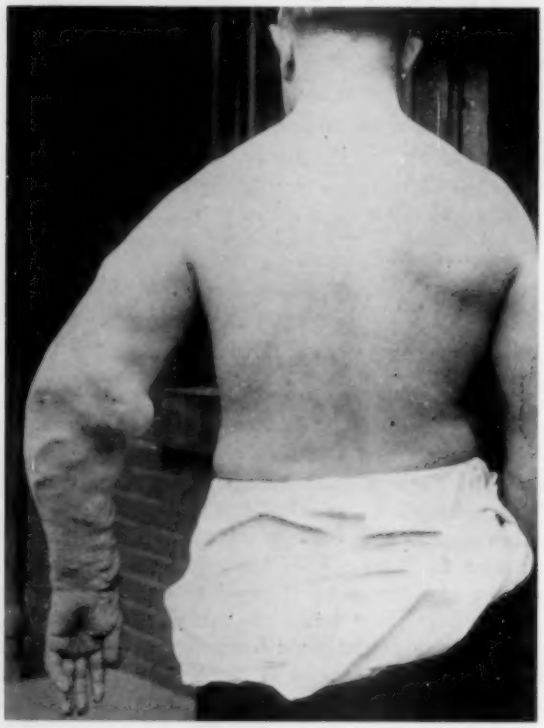

FIG. 1.—Congenital arteriovenous fistula of left brachial artery and vein, dorsal aspect.

When the patient came to me he had an unusually clear conception—for a layman—of what was in store for him. He had been advised by the surgeons of his home town to have the arm amputated and had even gone to the hospital for that purpose, but at the last moment it was suggested that he seek other advice—a rather fortunate circumstance in view of the fact that amputation could not possibly have been done successfully without preliminary treatment of the aneurism. And even if it had been successful, the cause of the trouble would still have remained.

The Examination.—The left arm of this man presented a most remarkable picture. Twice the size of the other arm, bluish-red in color, completely encompassed by pulsating, tortuous veins, varying in size from tiny things to huge engorged sinus-like affairs over an inch in diameter (Figs. 1 and 2), things that twisted and turned in the skin and under the skin trying to get more room, the arm hung from the shoulder at an angle of about 45°, and quite obviously throbbed as a whole with every heart beat. There was loss of sensation in the thumb and first two fingers and the whole hand was almost useless. Curiously enough, though, the venous tortuosity stopped at the wrist, probably due to the encircling fibrous structure at that point.

Palpation of the arm revealed, besides a generalized pulsation, an exquisitely painful area over the upper ulna—just where the patient had been injured. Nothing was felt in the bone at that point and X-ray failed to reveal a fracture. Numerous phleboliths could be felt in many of both the larger and smaller veins. But the thing that was most interesting was the thrill that could be felt in the higher veins. It could be heard with the stethoscope well down to the wrist, but it became more intense as one approached the

axilla, being loudest just under the pectoral muscles at which point a small throbbing swelling about the size of a walnut could be felt.

I figured that we were dealing with an arteriovenous aneurism of the first part of the brachial artery and vein. The thrill, in addition to being transmitted up into the neck vessels, was well heard over the triceps muscle, at which point there was an especially large, sensitive, pulsating vein. The heart, strange to say, was not enlarged. I felt sure that there must be some foreign body at the aneurismal point, but careful X-ray by Dr. J. Fletcher Lutz failed to reveal anything. His report is as follows:

"Examination made of left shoulder, arm and forearm shows marked soft tissue swelling, with scattered areas of calcification. There is no evidence of radiable foreign body in the region of the shoulder-joint; there is an absorption of the head of the radius; there is no evidence of fracture. Bones in wrist and hand are atrophic in character. Ulna and radius show some osteitis."

FIG. 2.—Congenital arteriovenous fistula of left brachial artery and vein, palmar aspect.

The patient was questioned carefully concerning the possibility of a stab wound, but he denied all knowledge of such a thing and certainly there was no scar to be seen in the axilla. It is possible, perhaps, that a suppurating gland might have eroded into the two vessels, as suggested by one of the house officers, but this is most remote. Such an eventuality surely must have ended fatally either from hemorrhage or from a septicæmia. Patient denied lues and his first blood Wassermann was negative. A later ice-box test was positive. Even so, it is hard to see how this alone could have produced such a lesion.

There was not, of course, much incentive to save the patient's arm. Even if it were possible to restore sensation and function, the huge venous wells would certainly become filled with clot and this would become infected upon the slightest provocation. More to the point was the necessity of curing the aneurism, in itself a task of no mean proportions. Separation of artery and vein with the restoration of each by suture, ideal though it may be, was rejected because it involved too much of an operation for the good that might accrue, since the outlook for the arm was poor at best. Complete excision of the aneurism—next to the ideal—was also rejected because of its position just below the clavicle and the probability that this, too, would be too much of an operation. Four point ligation was finally decided on as the procedure that offered the best results with the least danger. The arm was to be left to take care of itself; if there remained an adequate collateral circulation, well and good; and if not, amputation would be resorted to later. This position was really forced upon us, because to deal with the aneurism and remove the arm at the same sitting seemed too formidable even to contemplate.

The First Operation.—Accordingly, August 2, 1924, at the Union Memorial Hospital, with the patient under ether, a flap was laid back with its apex at the sterno-clavicular

junction and its base in the axilla. The pectoral muscles were cut through and the aneurism exposed. It was found to lie just far enough below the clavicle to permit of the passing of heavy silk ligatures around—first, the artery to shut off pulsation, and then the veins, although the vessels were so tremendous and looked so ominous and were so nearly flush with the clavicle, to say nothing of being surrounded by the various nerve structures to be found in this locality, that their dissection was most tedious and difficult. The artery was then ligated below the aneurismal point, after which all pulsation and filling of the previous bulge ceased. The vein below was similarly tied. All vessels were doubly ligated.

I seriously considered not ligating the veins at all—and had I suspected what was the true state of the circulation of the arm and what was going to happen, this would have been the wisest course to pursue—but it was so large that, with the slowed return flow that would follow the arterial ligation and the sure deposition of clots everywhere in its various bends, I feared an embolus. And I had real cause to fear this because just such a thing had happened to one of my earlier cases, the only difference being that the aneurism—this, too, was arteriovenous—was in the groin instead of the axilla.

There was no loss of blood and the patient left the table in good shape. Next day the arm was greatly swollen, the veins—especially those at the elbow—were quite tense, and the patient obviously was in great pain. The color of the arm—except for a patch on the palmar aspect of the forearm—was good, really better than it had been, since the skin was red where formerly it had been bluish-red. The hand was slightly mottled, but change of position cleared this up very nicely.

We were at a loss to explain this state of affairs. In fact, it did not become clear to us till a day or so later, when the increasing redness of the arm, the increasing swelling, the imminent tensity of the veins, the exquisite suffering of the patient, all combined to make it apparent that somehow, in some way, arterial blood in quantity was being pumped into the arm, while its outflow was effectually blocked. One way this could have happened was by the slipping of the arterial ligatures, but since there were two of these above the aneurism and two below this was hardly likely. A more rational explanation—and the one that proved to be true—was that there was a secondary arterial inflow to the arm. Under any circumstances, something had to be done.

The Second Operation.—Accordingly, August 7, five days after the original operation, amputation of the arm just below the shoulder-joint was decided on and carried out. And it had to be done without the use of a tourniquet, because I wished to lay back the original flap in order that the ligatures could be inspected, and also in order to secure, as high up as possible, any other artery that might present itself. Having correctly guessed the true nature of the trouble, and being acquainted from previous experience with the formidability of such operations and the liability of great loss of blood, the patient had been matched up for transfusion prior to operation and everything was in readiness for giving him blood.

To say that he needed it, is putting it mildly. In spite of our preparations he almost died before it could be given him. There were no vessels in that arm; instead there were huge blood sinuses that twisted and turned back on themselves, venous and arterial, so that one never seemed able to follow any logical lead. His muscles resembled a big sea sponge more than anything else, so that, in spite of the most rapid work and the use of nearly every clamp in the hospital, there was a devastating loss of blood. Arterial blood even spurted—actually—out of the marrow cavity of the bone when it was cut across, necessitating the use of a large chunk of bone wax. I have never seen such a condition before.

By the time the arm was removed the patient was almost *in extremis*. He was given 500 c.c. of citrated blood and saved, though he went off the table in desperate shape. Later on he was given a second transfusion, and then a third. His convalescence was somewhat prolonged and the skin flaps, which had been sutured roughly and in haste, pulled apart, leaving the wound to heal chiefly by granulation, but a complete recovery ensued.

Post-operative Consideration.—Even now, though, I am not certain how that secondary arterial supply came in, since it was impossible to do much investigating at the time of operation. All that can be said is that there *must* have been a secondary inflow because the ligatures as originally placed around the artery were inspected at the time of amputation and found to be holding fast, the aneurismal bulge was not pulsating, and the frightful hemorrhage encountered at amputation could not otherwise have occurred. More than likely there was a vessel which branched off from the subclavian artery—above the site of the aneurism—and worked its way into the arm and downwards through the deeper tissues.†

One other explanation is that offered at the Hospital Staff Meeting by Dr. John Staige Davis, who suggested that the whole condition might have originated in an hæmangioma which, starting in the skin of the forearm as a "bunch of grapes"—to use the patient's own description—worked its way inward and finally took on the dread intra-muscular variety. The patient's story of the early beginnings of the affair does lend some basis to this theory and certainly the intra-muscular hæmangiomata can give pictures somewhat similar to this, but I cannot see how an arteriovenous fistula between the two largest vessels of the arm could arise in this manner.

More than likely the condition was a congenital arteriovenous fistula with an abnormal secondary arterial blood supply that arose from the subclavian artery above the fistula.

† As so often happens when one wishes to save a valuable specimen, the arm was put into the incinerator before it could be dissected, the house officer having forgotten to order it preserved.

SO-CALLED IDIOPATHIC DILATATION OF THE ŒSOPHAGUS

TREATMENT AND REPORT OF CASES

By Peter Nicolay Bull, M.D.

of Oslo (Christiania), Norway

professor of surgery in the university of oslo (christiania)
surgeon in chief to the riks hospital

(*Continued from page 93*)

TREATMENT

The principles of this will partly depend upon the view of the pathogenesis taken by the physician in charge. Those who believe that the spasm is the most important factor will in their therapy specially aim at that; others, who consider that œsophagitis is the main source of all the misfortune, will specially treat the latter. Even if we regard both spasm and œsophagitis as secondary, it must be admitted that in many cases a treatment directed towards them will be of extremely great importance for the patient, even if a relapse occurs sooner or later after treatment has ceased.

A. PALLIATIVE TREATMENT

To this belong:

(a) *Dietetic Treatment.*—Many patients discover by years of experience the régime they should follow. In the majority of cases it is no doubt the rule that fluid or semi-fluid food passes down into the stomach more easily than solid food. They therefore, as far as possible, keep to milk, soups, eggs, omelettes, porridge, etc., and drink profusely at meals. However, what suits one patient does not always agree with another; thus, the majority can take hot drinks best, but it happens that some prefer cold ones. The patient must accustom himself to eat slowly and to chew his food thoroughly.

(b) Patients who have not taught themselves the said *advisable movements* in order to press the food down into the stomach must be instructed therein.

(c) When there are clinical signs of uncomfortable retention in the œsophagus, *regular lavages* will be of great service. They should be made once or twice daily, according to the dimensions of the retention, from one-half to one to two hours after meals; we must experiment in order to find the most suitable time for each patient. It is especially advisable to lavage in the evening in order to avoid inconvenience during the night from the filled œsophagus. By the addition of alkalies, *e.g.*, bicarb. natric., to the flushing water, it will be easier to remove slime from the œsophagus. As the use of the aspirator may cause pain and increased secretion of slime, it may be preferable to make use of the syphon alone. Complete removal by lavage

readily causes pain, and therefore the entire contents of the œsophagus should either not be completely removed, or when lavage is completed, a quantity of water should be poured in again, or as Bensaude and Guénaux advise, 30 c.cms. of warm oil should be introduced for the treatment of œsophagitis.

By the removal of the stagnating and sometimes decomposed contents of the œsophagus, the lavages will reduce the intoxication connected therewith, and especially exercise a beneficial influence upon secondary œsophagitis.

According to her own statement, one of my patients (Case III) has with her husband's help introduced the tube for lavaging 50,000 times in the course of fifteen years. To judge by the happy appearance of the married couple, in spite of the wife's lengthy illness, the tube has also served as an original but effective bond to unite them more closely together.

(d) The tube can also be employed for artificial feeding in those cases where it is almost or entirely impossible for the patient to get food into the stomach by swallowing; of course the condition must be that the tube really can be inserted down to the stomach, and is not merely curled up in the œsophagus.

(e) Of the medicines that are considered to exercise a direct influence upon the power of the œsophagus to empty itself, there is *atropin*, which by paralyzing the vagus is said to produce a relaxation of cardia; the same is said to be possible with *papaverin*, which paralyzes the non-striated muscles.

(f) Psychic influence is also said to have been employed in certain cases with very favorable results in some of them.

B. DILATATION OF CARDIA

This can take place with the aid of probes or instruments that are inserted per os., or the distention takes place per laparotomiam.

(a) *Dilatation by means of probes* often has excellent effects and should always be tried before more serious methods are attempted. The best are blunt probes filled with lead or mercury. The probes should never be used more than twice a week, and should be allowed to remain for one-half to three-quarters of an hour. We must proceed to the use of No. 50–60 Charrière if the effects are to last for any appreciable time.

Guisez prefers to insert three thin probes side by side; on the first occasions it may be necessary to employ the œsophagoscope in order to get the probe in its correct place; *Guisez* maintains that by probing he has cured practically all cases in the course of five or six months. Most other writers, however, consider that probing is followed by a relapse, and that blocking must be repeated from time to time.

The difficulty in treatment with the probe is that it is not always possible to get it down into the stomach; an even worse feature is that physicians or patients themselves can produce a fatal perforation of the œsophagus (acute mediastinitis, peritonitis, or empyema pleuræ).

Instead of the usual probes, we may employ those constructed with a

special view to the dilatation of cardia. The principle of these is that the probe is hollow, and at its lowest part is provided with a *rubber or silk balloon*, which can be inflated by means of a pump. *J. C. Russel* employed this kind of probe as early as in 1887; the balloon was situated at the lower end of the probe, was inflated when in the stomach, and then in inflated condition drawn back through cardia. Better than the above are probes in which the balloon does not extend outside the lower end of the probe but covers 8 to 10 cms. of it; *Gottstein* made an improvement in these, so that when the balloon is inflated after being placed in cardia, it assumes the shape of an hour-glass, so that it cannot slip out of position. Instead of using air, we may also fill the balloon with water at a pressure of 60 to 70 cms. (Wilms.) We commence by dilating two or three times a week, and by degrees proceed to once every other week or once a month. We dilate to a diameter of 4 cms., *i.e.*, 12 cms. in circumference, the pain produced by extension each time indicating how far we may proceed for the time being.

Instead of balloon probes we may employ specially constructed dilating instruments (*e.g.*, Bruning's "cardiodilators").

In cases where on account of complete hindrance to receiving nourishment gastrostomy has been performed, "probing without end" has naturally appeared to be a suitable method, and has been tried. The result has not been good, or the effect has been only quite temporary (Martin and my Case I). Gastrostomy can also be employed to get the balloon probe into place in specially difficult cases; the patient is first made to swallow a thread, which is fished out through the gastrostomy opening, and thereby serves as a guiding line to the balloon probe through œsophagus and cardia.

(b) *Mikulicz* (1904) was the first to plan and carry out *forced dilatation of cardia per laparotomiam*. He opened the stomach broadly, then inserted a pair of forceps, the branches of which were covered with rubber, and were so constructed that they were parallel when opened. The forceps is introduced through cardia closed, until it is felt that the wide part of the œsophagus has been reached, *i.e.*, 5 or 6 cms. When they have been brought in place, the branches are opened so that they are 6 cms. from each other.

Instead of using forceps we may insert two fingers into cardia and spread them as widely apart as possible (*Hj. v. Bonsdorff*, 1906), or we may first insert the point of the first finger through cardia and then by degrees insert others, so that at last the points of the four ulnar fingers have been forced in (*Tage Hausen*, Cf. Kramer-Petersen, 1908). We may also dilate cardia without opening the stomach, forcing the anterior wall of the stomach by means of a finger up through cardia like the finger of a glove, and then subsequently letting other fingers follow (*Lindström*, 1918).

As will be seen, Mikulicz's operation and its variants aim at forcing cardia, in analogy with divulsio ani for fissure. Good results may be achieved in some cases, but relapse follows in others. Of nineteen operated persons, one died of mediastinitis. (Quoted from Thieding.)

C. OPERATIONS ON THE ŒSOPHAGUS, ESPECIALLY ON ITS LOWER END

The lower end of the œsophagus and cardia, on account of their anatomical situation, cause a number of difficulties, which to a certain extent are common to all the operations I am about to discuss. As it is an absolute necessity to be fully acquainted with the nature of these difficulties, I will first give a brief survey of the latter.

The following spectres in particular threaten the surgeon:

(1) *The difficult access* to the field of operation.

(2) *Lesion of pleura, with pneumothorax.*

(3) *Infection* of one or more of the three serous membranes that lie close to each other at this spot (pleura, pericardium, peritoneum); or infection of the mediastinal connective tissue.

(4) *Lesion of nervi vagi.*

(5) *Lesion of vessels.*

(6) The defective serosa covering of the œsophagus, with the consequent *difficulties in making reliable suture.*

Re (1) Excellent access to cardia is given by *Marwedel's incision* along the left costal arch, with section of the cartilage of the seventh and ninth ribs. A pillow is placed under the patient's back in order to bring the epigastrium forward. As these patients are thin and often have gastroptosis, it is all the easier to approach cardia.

Re (2) Pleura mediastinalis is easily loosened bluntly from the œsophagus; as moreover on account of the dilatation it is forced to one side, the risk of lesion should not be very great. It is doubtful whether I have seen pleura at all in any of my patients during the operation.

Re (3) *The danger of infection* is considerably diminished if some considerable time beforehand the œsophagus is carefully rinsed clean, preferably several times daily. The stomach is best kept empty for the operation by prohibiting the patient from taking food per os after 12 noon on the day before the operation. It is doubtful whether lavage should be undertaken on the morning of the day of the operation, as some of the water may remain in the œsophagus, or to some degree run down from the latter into the stomach.

The mediastinum is best protected against infection from the abdominal cavity by again carefully suturing the loosened œsophagus to the edge of the opening of the diaphragm.

Re (4) Lesion of nervi vagi, and even section of both, are, judging from experiments on animals, without appreciable importance, if section takes place just above or just below the diaphragm; both secretion and mobility are satisfactorily attended to by autonome ganglia in the wall of the stomach and intestine respectively (*E. Heller, Knud Nicolaysen*). In my first case, it is true, both vagi were cut during the cardioplastie. By irritation of vagus at the lowest section of the thorax there occurs no inhibitive reflex, but on the other hand, pulling of vagus should be avoided, because there may occur alterations of the pulse or respiration on account of transference of the pull to branches leaving higher up.

Re (5) The danger of *lesion of vessels* is not so imminent as might be believed from an anatomical aspect. It is true that vena cava lies to the right anteriorly, and behind the œsophagus lie from the left to the right aorta, ductus thoracicus, and vena azygos. The two latter, at any rate, lie so far back that they do not come into view.

Re (6) As is known, the œsophagus has a bad reputation when suture is concerned; its wall is brittle and its contents infective, especially in the disease here concerned. Several writers therefore consider that in order to relieve a subsequent suture during the first days after the operation, a provisional gastrostomy should be performed, and it should not be closed again before it is certain that the sutures hold. My first patient had suffered from stomach fistula for a whole year before I performed œsophago-gastrostomy; simultaneously with the latter I closed the stomach fistula and the wound healed nevertheless per primam. I have therefore in the last three cases renounced gastrostomy without inconvenience to the patients, and as in all my cases primary healing occurred, it would appear that gastrostomy is superfluous. At any rate, it indicates a complication, even if not one of the most serious. At the same time it involves the patient in at least one extra operation and a prolongation of his stay in hospital.

If there is uncertainty regarding a suture of the œsophagus, or as to whether the œsophagus has been injured during the operation, the wound should be drained for the first days afterwards.

The operations that have been performed upon the œsophagus, especially upon its lower end, are as follows:

(a) In 1906, *Reisinger* exposed the œsophagus after resection of the fourth-seventh ribs on the right surface of the back, and at a later operation excised a large piece of the wall of the œsophagus (15 x 2–3 cms.) The patient's condition was somewhat improved. This operation has not been repeated by others.

(b) *Cardioplastie* à la Heinecke-Mikulicz pyloroplastie has been performed by several surgeons (Wendel, 1910, Lecène, Sencert, Girard) with varying results.

(c) In analogy with Fredet-Rammstedt's operation in congenital hypertrophy of the pylorus, *E. Heller* in 1913 performed the *extramucous cardioplastie* previously proposed by Gottstein. The œsophagus is first loosened out of the hiatus of the diaphragm up to 8 to 10 cms. from cardia, and two longitudinal cuts are then made into submucosa, 8 cms. in length, one on the anterior and one on the posterior surface of the œsophagus, continuing from the œsophagus into the wall of the stomach.

At the German Surgical Congress in 1921, Heller was able to report that twenty-one operations had been performed by various surgeons according to this method. Of these seventeen had good results, four unsatisfactory. There were no deaths.

When performing extramucous cardioplastie, it has happened to several

surgeons that they have involuntarily opened the œsophagus (Girard, Clairmont, Bull); as the hole must be closed reliably in some way or other, we thereby risk forfeiting good results in the operation.

Schaldemose (1915) modified Heller's operation, so that instead of a longitudinal section he made a complete circular section 1 cm. above cardia, through the muscular coat into submucosa. The result was good.

Röpke's method (1914) is a less fortunate variant of the two preceding ones. By means of pincettes he removes connective tissue, nerves, and muscles into submucosa, from cardia upwards, until the dilated part of the œsophagus begins. Of three cases that were operated in this manner, one was cured, one was reoperated on account of a recurrence, and one died (Borchgrevinck) of pericarditis. As in addition a hole was torn in the mucous membrane in two of the cases, as might well be expected, the method is not worthy of recommendation.

(d) *Sencert* (1921) proposed that we should restrict ourselves to loosening the œsophagus from hiatus, draw it down as far as possible, and then fasten it to the edge of hiatus. Sencert believes that the essential obstacle to discharge is that the œsophagus is too long and therefore easily bends. It can be straightened out if we draw it sufficiently far down. Sencert has doubtless not been convinced of the effects of this, since in addition he performed cardioplastie à la Heinecke-Mikulicz upon his patient.

It may be objected against "pulling down" alone, that as by degrees we loosen the œsophagus in the mediastinum and draw it down, we constantly pull broader portions of the dilated œsophagus, the wall of which, moreover, is generally thickened. It therefore fills out hiatus more than before loosening, and its walls must be compressed by the edges of hiatus.

Tuffier once sewed the stomach and œsophagus together, after pulling down the latter without performing anastomosis, but the result was not entirely satisfactory.

(e) *R. Grégoire* (1923) gives a method whereby he exposes the lower part of the œsophagus, without opening pleura or peritoneum. The patient lies on his right side, a large U-shaped incision is made, with the convexity downwards, over the lower part of the left thorax, preparation of a flap consisting of soft parts and of the three lower ribs, pleura parietal and mediastinal, which is bluntly stripped off from the spine, aorta, œsophagus, and diaphragm, the muscles of which are divided radially towards hiatus without injuring the peritoneum; the œsophagus is loosened from hiatus, and we may then either perform a plastic upon it, or draw it down; finally, a débridement is made of the left crus diaphragmaticum, since Grégoire considers that the obstruction is mainly due to a spasm in crura or a constriction there.

(f) *Heyrovsky* in 1910 performed the first *œsophago-gastrostomia subdiaphragmatica:* Marwedel's incision, loosening of the œsophagus in hiatus, and then anastomosis between the lower part of the œsophagus and fundus ventriculi. Sixteen patients have now been operated in this way: Heyrovsky,

3; Sauerbruch,* 3; Finisterer, 2; Enderlen, Exner, Gröndahl, and Schnitzler, 1 each; and the present writer, 4. One patient died from the operation (Sauerbruch); the result in Gröndahl's case was not satisfactory, but then neither was the diagnosis "idiopathic dilatation of the œsophagus" convincing. In one of my cases there occurred a considerable improvement, but not entire freedom from symptoms. In all the other cases the results were good, and in the majority entirely ideal and lasting.

Lambert once performed gastro-œsophagostomy by the aid of forceps: Gastrostomy, one arm of the forceps is inserted through cardia up into the œsophagus, the other up towards fundus ventriculi, and the forceps is shut. The wall of the œsophagus and the right side of fundus ventriculi are then pressed towards each other. The handle of the forceps is brought out through the opening in the stomach and the wound in the abdomen. The stomach around the handle of the forceps is fixed to the wall of the abdomen. The forceps is gradually closed tighter and tighter in order to produce necrosis of the tissue, and is removed after three weeks. The result was good.

As I have on four occasions performed *œsophago-gastrostomia subdiaphragmatica* I will give a more exact description of the method of performing this operation and report further details regarding the final results of my cases:

Pillow at the back in order to get the epigastrium well forward. Marwedel's incision. Cardia is easily reached in these thin patients, so much the more so because they often suffer from gastroptosis. Peritoneum over the abdominal part of œsophagus is circumcised high up, after which it is easy to place a finger around this part of the œsophagus, and apply a gauze sling around it. By the aid of the latter the œsophagus and cardia are pulled out, whilst at the same time the œsophagus is gradually loosened from hiatus œsophageus by the aid of a finger or pieces of gauze on a pair of forceps. In the course of this it is usually possible to discern one or both nervi vagi without difficulty, stretched like strings and to some extent preventing the pulling of œsophagus as far down as desirable. If this is the case we can at once cut through one or both of them. When the œsophagus has been drawn down as far as possible, *i.e.*, about 8 cms. or more, it is fixed by four or five threads to the edge of hiatus œsophageus, partly in order to shut off mediastinum from the abdominal cavity and thereby diminish the risk of infection for the latter, and partly in order to prevent the œsophagus from returning upwards again. The danger of this is not very great if we remember that the œsophagus in this disease is usually too long, and is therefore scarcely likely to exercise any great pull upwards after having been loosened in hiatus.

In applying the anastomosis I have always placed forceps on fundus ventriculi but not on the œsophagus. Sometimes I have closed the latter as high as possible by tying a thin rubber tube around it. We then sew the left

* It does not clearly appear from Sauerbruch's report to the Surgical Congress in 1921 whether he followed Heyrovsky's method or not.

side of the œsophagus to the right side of fundus ventriculi; these parts fall together quite naturally without any trace of tension, when we draw on the gauze sling previously applied. We use the finest intestine needles and silk, or catgut No. o or oo, mucous membrane suture always with catgut. The suture commences at cardia and is continued upward, the application of the following sutures being facilitated by constantly pulling on those first applied. I have sometimes sewn in two layers, sometimes in three.

When the stomach is opened, there is a risk that some of the contents may run out, for the night before a quantity of saliva and slime collects in the œsophagus, some of which in the course of the night runs into the stomach. I believe that the disadvantages of this are less than those incurred by lavaging on the actual day of the operation.

The incisions in the œsophagus and stomach are six or seven cms. in length. I have not always let the œsophageal incision extend equally far down into the stomach, though always through cardia, so that I could see the latter from within. In one case I continued the incision in the œsophagus in an arc through cardia over towards the left, so that it there met the incision of the stomach. Anastomosis was thereby performed in complete analogy with Finney's gastroduodenostomy, a method of procedure that was also employed by Gröndahl in 1916.

In three cases, after completing the œsophago-gastrostomy, I applied a large cigarette drain against cardia, and in one case I closed the wound without drainage. In all cases there was primary healing.

Œsophago-gastrostomy would have the best effects if it could always be placed at the lowest point of the œsophagus; but as in many instances this lies far to the right of the mid-line, we should in that case have to pass through the right half of the diaphragm. The technical difficulties and risk of the operation would thereby be even greater than in Heyrovsky's method.

The *after-treatment* has consisted of drip-clysters with nothing per os for six or seven days; after that careful drinking of water, and, if everything goes well, milk or soup the same day. Even after the first draught all my patients have stated that they swallowed much more easily than before the operation.

The *results* of œsophago-gastrostomy have been quite ideal in three of my patients. They eat with practically speaking no inconvenience, and swallow just as easily as other people. They have given up their old manœuvres to get the food down and have increased in weight. They express themselves in superlatives every time I write to inquire how they are. Perhaps the statement made by Case III is most characteristic: "I look forward with pleasure to my meals and enjoy my new existence." It is now three years since the first patient was operated. The result is thus entirely satisfactory clinically, but none of my patients are quite free from a slight retention after the contrast meal, although this, as mentioned before, is not apparent clinically. Perhaps these patients more readily have retention in the œsophagus after the unphysiological barium porridge than after ordinary food.

The fourth of my patients (Case II) was in excellent health for two or

three months, but then her food began to rise periodically after eating, so that she had to resort to her old tricks to get it up or down, or she used the tube and washed herself out. But even in this case there was a considerable improvement in spite of everything. Thus she increased fifteen or sixteen kilos in weight and is entirely devoid of pains. An X-ray photogram taken nine months after the operation shows less retention in the œsophagus after two and one-half hours than after twenty-four hours before the operation (Cf. Fig. 4, Fig. 5).

What is the cause of the favorable results of œsophago-gastrostomy? If it is assumed that the obstruction is situated in cardia itself, it follows *per se* that œsophago-gastrostomy affects the latter. If, on the other hand, it is assumed that the obstruction takes place because the œsophagus is too long, and that there is a kink above hiatus, it may perhaps be more difficult to understand the favorable effects of œsophago-gastrostomy. There are, however, three circumstances that can contribute towards this: The œsophagus is loosened out of hiatus and thorax and is drawn down, so that afterwards it is more stretched. The manœuvres, by loosening œsophagus in hiatus, undoubtedly will stretch the edges of the hiatus, making it more open than before. Finally, the sewing of the œsophagus to the stomach and of the latter to the diaphragm effectively prevents the œsophagus from withdrawing up into mediastinum again.

D. GASTROSTOMY

This is performed after almost completely hindered taking of nourishment, when it is impossible to introduce a tube into the stomach per os. When, however, a more curative operation has been decided upon, if the patient recovers after the formation of fistula, we should undoubtedly prefer jejunostomy to gastrostomy; in operating afterwards upon cardia there will not be so great inconvenience as in gastrostomy with its adhesions.

When there is very marked œsophagitis and the retained contents are very malodorous, there may be a question of performing gastrostomy or jejunostomy in order to avoid the taking of nourishment per os. It will then be possible to improve the œsophagitis more quickly by continued lavages, and diminish the danger of infection at an eventual operation.

Gastrostomy is also performed in order to fish up a thread that has been swallowed and thereby place a balloon probe at the right place in cardia.

As mentioned before, gastrostomy is employed by some surgeons as a safety-valve in operations upon cardia and the lower part of the œsophagus.

Having thus given a general survey of the various methods of treatment, some guidance should be offered as to the choice of these methods.

In *slight cases* patients can manage for a long time by dietetic measures, and by the employment of the "tricks" that experience has taught them will pass the food down into the stomach.

As soon as we must resort to lavaging in order to produce an alleviation of the symptoms, we have indications that we should employ *blocking* with

bougies or balloon probes. On the contrary, "probing without end" cannot be recommended.

If by blocking no improvement is achieved, or it cannot be carried out or is constantly succeeded by relapses, we must then take under serious consideration the performance of one of the operations that experience has taught us are most reliable both as regards their lack of danger and their durable effects. In this category we cannot include cardioplastie à la Heinecke-Mikulicz, because suture of œsophagus alone will always be unreliable. It is improbable that Reisinger's and Röpke's operation will find imitators. We still lack sufficient clinical experiences regarding Schaldemose's circular incision and regarding Sencert's and Grégoire's operations. We thus have left the forced dilatation à la Mikulicz, Heller's extramucous cardioplastie, and Heyrovsky's œsophago-gastrostomy. Mikulicz's operation and its variants have the advantage of not presenting any noteworthy technical difficulties, and of being quickly performed. But there are certain drawbacks connected with them. We to some extent operate blindly, so that it is not easy to secure the degree of dilatation that on the one hand is fully effective and on the other hand does no harm. Exaggeration of dilatation may result in lesions of the œsophagus, with consequent infection, and too great caution may easily cause a relapse.

In my opinion, the essential thing is to choose between extramucous cardioplastie and subdiaphragmatic œsophago-gastrostomy. There is a special reason why I have decided upon œsophago-gastrostomy.

In my first patient I had planned an extramucous discission à la Heller. It happened to me, as to several others, that in the course of the operation I perforated the mucous membrane. In order to close this reliably, I applied two or three catgut sutures in the mucous membrane and sewed together the longitudinal cut in the muscles à la Heinecke-Mikulicz. The effects of this irregular operation were not good. After the lapse of eleven days there occurred, as on two previous occasions in the patient's life, a complete obstacle to nourishment, and as after waiting a further eight days there was no improvement, and it was not possible to insert a tube into the stomach, I was compelled to resort to gastrostomy. The patient was then sent home with a stomach fistula. Some months later he contracted an abscess in the immediate vicinity of the fistula. Fortunately it opened outwardly spontaneously. One year after the formation of the fistula he returned and demanded to have it removed. I then performed my first œsophago-gastrostomy, and at the same time closed his stomach fistula. As every one will understand, this operation was performed under very unfavorable circumstances, since on account of the two preceding operations and the formation of an abscess there were extensive adhesions between the stomach, the anterior abdominal wall, and the liver. Nevertheless the operation proceeded without complications, and the final result was entirely ideal. I therefore came to the conviction that œsophago-gastrostomy is reliable in its effects, and technically not as difficult as might

be assumed beforehand, if under such difficult circumstances it could be so successful.

I have had this experience further confirmed by three subsequent operations, and there should thus scarcely be any reason why I should recommend any other method. Yet, on reading the casuistic reports of the various operations that are performed, all with more or less good results, we are struck by certain common features that are found in them all. To these belong first and foremost the loosening of the œsophagus in hiatus and drawing it down. With Sencert I regard this as an essential factor in the achievement of a good result, irrespective of further procedure. In the next place, considerable importance must be attached to an enlargement of hiatus, whether this takes place intentionally or unintentionally. Röpke, as early as in 1914, performed débridement of the edges around hiatus, and this constitutes an essential feature of Grégoire's operation. It would probably be wisest to make a series of small cuts in the edges.

Can we perhaps restrict ourselves to loosening, drawing down, or débridement? Or is it absolutely necessary to do more? We still lack adequate clinical experience regarding this. The simplest supplement to the foregoing would be Heller's extramucous cardioplastie. If in future during the performance of such an operation I again perforate the mucous membrane of the œsophagus, I shall not attempt to close it, but at once proceed to perform œsophago-gastrostomy, if the situation of the hole permits.

The rôle played by gastrostomy has been sufficiently discussed above.

CASE REPORTS

Case I.—Male, aged fifty-one years (Edvin M.), from his 26th to 31st years suffered from an obscure affection associated with cough and with post-sternal pain, sometimes referred to the back. He expectorated a thick, viscid sputum, for the expulsion of which, cough was not always required. He frequently simply stretched his neck and sucked it up. The beginning of his complaint was a "supposed cold." He was never confined to his bed; gradually got quite well again; never had any trouble in swallowing until ten years later. When he was forty years of age, in the autumn of 1910, while heated by working in the fields, he lay down on the ground and drank copiously of cold water. Then, for the first time, he could not get down the last mouthfuls but had to spit them out again. Some weeks later he suddenly developed pronounced difficulty in swallowing. This difficulty did not come on gradually but was pronounced from the first day and continued in the same degree for years thereafter. At every meal, after having eaten two or three mouthfuls, he was compelled to go out and disgorge. After a time he developed a method of deglutition in which he made a vigorous swallowing of air accompanied by straining as if to empty the bowel. In this manner he was able to force food down into his stomach. Later, after swallowing in this manner he would be compelled to vomit some of the food if he started working immediately after his meal. In the beginning of 1919, he began to suffer from intermittent spells of inability to swallow anything. At one period, for thirteen days, he regurgitated everything he tried to swallow. At this time he was admitted to the Bodo Hospital, where ineffectual attempts to pass a bougie were made. At the end of the thirteen days he began again to swallow, but with difficulty, and the old condition of dysphagia returned. When admitted to the Serafimer Hospital, August 5, 1920, he had not been able to swallow anything for nine days and his condition was one of threatening starvation. During all this period the movement of his bowels and the voiding of urine had been

generally normal, though scant. When admitted, he was emaciated, weighing 51.7 kilograms. The abdomen was scaphoid and flaccid and not tender. A bougie the thickness of a finger was passed into the stomach without much difficulty, after which the patient was able to swallow fairly well. X-ray revealed a considerable even dilatation of the œsophagus with the convexity towards the right side narrowing off in the direction of the cardia. (Fig. 1.)

For a few days the passing of the bougie was continued and during this time he was able to swallow fairly well. On account, however, of the complete obstruction to the passage of food of any kind which had repeatedly occurred in his past history, a plastic operation was determined upon and carried out August 14, 1920.

Operation.—Marwedel incision. Peritoneum covering abdominal portion of œsophagus incised. Œsophagus loosened bluntly and pulled forward by means of a gauze sling. The loosening of the œsophagus was continued through the œsophageal opening in the diaphragm up into the mediastinum. It was found necessary to divide the two vagi nerves in order to bring the œsophagus down to a satisfactory degree. Œsophagus and cardia now were split open anteriorly for a distance of five centimetres midway between the great and lesser curvatures. No thickening of the muscular coat was found present. The intention was to carry the incision only down to the mucosa after the method of Heller, but accidentally an opening was made through the mucous membrane. After this had been sutured with catgut, the rest of the incision was sutured transversely in two layers. Superficial abdominal wound sutured as usual. At the close of the operation, the pulse was 68.

Post-operative Course.—From the fourth day allowed to swallow fluids, which he accomplished fairly well. On the ninth day some slight regurgitation. From the eleventh day it was quite impossible for him to get any food down into the stomach. Primary union of the operation wounds. On the fourteenth day attempt to pass a bougie through œsophagus was ineffectual. At the end of the subsequent week he was still unable to get any food through the œsophagus, being nourished by enemata.

On September 2, *second operation.* Gastrostomy after method of Kader. The day before operation a ureteral catheter was passed through mouth into the stomach, where it was allowed to remain. The operative incision was made through the sheath of the left rectus. Stomach exposed and opened; the ureteral catheter fished out through the incision and silk thread tied to it, and by withdrawing the catheter through the mouth, the end of the thread was pulled out with it. A Nélaton catheter, No. 26, was introduced into the stomach and the wall of the stomach closed tightly around it after the method of Kader. The abdomen also closed in the same manner. The following day, the patient was given nourishment through the catheter, some of which he gulped up. On washing out the œsophagus, 500 cubic centimetres of foul-smelling content were removed. Daily irrigations of the œsophagus were made during the following weeks with gradual reduction of the amount of retention found present to 50 cubic centimetres.

September 27, twenty-five days post-operationem, retrograde dilatation of the cardia was begun, with the aid of the silk thread, after the manner of Von Hacker with rubber bougies, the dimensions being gradually increased. These bougies were allowed to remain in the cardia for eight to twenty-four hours. By the fourth day a bougie the size of a little finger could be passed. After this had been removed, patient was able to swallow into the stomach some blue-colored water, as demonstrated by its escape through the abdominal fistula five minutes later. At the end of three weeks more, the daily use of the bougies having been persisted in, patient states that when he swallows thin gruel the first mouthfuls only pass down into the stomach, the remainder being held in the œsophagus, but by administering nourishment through the abdominal fistula catheter, patient has increased in weight about 7 kilograms. He was then sent home to continue to use the abdominal fistula catheter for feeding himself.

One year later, September 12, 1921, patient was readmitted to the hospital. During this period he had been dependent entirely upon feeding through the abdominal fistula.

When admitted he was somewhat pale, but otherwise looked fairly well, weight being about the same as when discharged in October, 1920. No food passes down into the stomach when he swallows, even water is arrested at the cardia and is soon gulped up again. X-ray shows about the same details as were found the previous year. The dilatation of the œsophagus is even and considerable. It narrows off towards the lower end, terminating in a small pointed tip. An obliquely taken röntgenogram shows that the lower part of the œsophagus curves slightly from behind forwards.

Operation.—October 3. Œsophago-gastrostomia subdiaphragmatica. Under morphine, scopolamine, ether narcosis. The old abdominal scar, together with the gastrostomy opening, were incised. Stomach loosened from its adhesions to the abdominal wall and the fistula opening in the stomach sutured in three layers. The fundus of the stomach was only loosely adherent to the abdominal wall and diaphragm, but strong adhesions between stomach and liver were broken up with considerable difficulty. The loosened cardia was pulled forward, together with the œsophagus, by means of a gauze sling. A circular incision was made into the peritoneum, covering the abdominal portion of the œsophagus, which permitted it to be easily loosened from the diaphragm, also from the adjacent parts in the mediastinum. Four or five centimetres of the œsophagus were brought out in this manner. Anastomosis was then established between the right side of the fundus of the stomach and the front of the gullet, suturing in three layers—the two inner layers with catgut, the outer with silk. The silk outer sutures of the posterior wall were interrupted, the others continuous. Some fluid escaped from the stomach, very little from the œsophagus. The incision into the œsophagus was carried down through the cardia and from one to two centimetres beyond, but not continuous with the incision in the stomach. The length of the opening of the anastomosis was from four to five centimetres. The œsophagus was fastened by three silk sutures to the margins of the œsophageal opening in the diaphragm. Two cigarette drains were applied to the site of the anastomosis, the rest of the wound was sutured in layers. The difficult operation took three hours to complete. An intravenous injection of one and one-half litres of saline solution was administered at its close.

Post-operative Course.—Afebrile and uneventful. Nothing was administered through the mouth during this period. At the end of the week he was given fluids per os and was able to drink four glasses of water without any difficulty and exclaimed that not for twelve years had he been able to swallow with such ease. The drains had been removed from the abdominal wound after five days. Healing per primam. During the succeeding two weeks his condition continued to remain good, with ability to swallow solid food as well as fluids. At times some evidences of œsophageal retention were manifest. As long as his food is liquid and he allows himself plenty of time in its deglutition, he does not regurgitate any of it. X-ray shows the dilatation to be much less marked than before the operation. After another two weeks, swallowing had become still more natural. He had an excellent appetite and had gained three kilograms in weight in the week. He was then allowed to go home. A letter received from him, dated July 4, 1923, states: "I am now weighing 63 kilograms, which is about the same weight as four years ago before the period of starvation. There is no food that I cannot manage now, only when eating bread made of fine flour, I must always have something to drink."

Case II.—Woman, aged fifty-two years. Tendency to dysphagia exhibited in early childhood; aggravated at maturity. *Œsophago-gastrostomia subdiaphragmatica.* Irregular after-course; final great improvement.

Since earliest recollection had difficulty in swallowing food. Condition aggravated at eighteen years of age following birth of first child. To this date she refers the beginning of marked difficulties in swallowing, which have followed her throughout her life since. At meal-times, after a few mouthfuls, food would regurgitate. This occurrence would be repeated, the cycle being, eating, drinking, regurgitation. At meals this process would be repeated several times, until, after having spent one hour at table, she

would rise as hungry as she sat down. At times some food would be passed into the stomach after adopting a manœuvre consisting of pacing up and down the room, throwing her shoulders back, pushing out her chest and abdomen, taking a deep breath and then straining hard. At times after this effort she would experience a feeling as if something had given way and of the food rushing into the stomach. After a successful effort of this kind, she was always able to swallow more easily for a day or two. She often suffered from regurgitations of food during the night. When admitted, April 10, 1922, she was anæmic and weighed 41 kilograms. The abdomen was flaccid, gastro-coloptosis was marked. Heart, lungs, and kidneys normal. Stomach tube could not be passed into stomach. Irrigations of œsophagus brought away food rests. Röntgen examination showed œsophagus much dilated. (See Figs. 3 and 4.) Barium meal accumulated in a great loop resting upon the diaphragm, the lower end ending in a point. Œsophageal bougie may be seen to strike the front wall of the œsophagus. At the end of twenty-four hours still residue in the œsophagus. (Fig. 5.) After having abstained from food for sixteen hours, 150 cubic centimetres of food rests were removed by aspiration from the œsophagus.

Operation.—April 25, 1922. *Œsophago-gastrostomia subdiaphragmatica.* Morphine, scopolamine, ether narcosis. Marwedel incision. No thickening or contraction of the cardia found present upon exposure of the œsophagus.

Operative Technic.—Same as in Case I. Left vagus only was divided to permit the pulling down of the œsophagus. The œsophagus as exposed was funnel-shaped, its greatest diameter being three times that of the normal. The apex of the funnel pointed towards the cardia. Duration of operation, two hours and twenty-five minutes.

Post-operative Course.—Uneventful. On sixth day began to drink water. Previous to this had depended upon clysters by drop method. By ninth day could drink without difficulty one-half tumbler of water at a time without experiencing any feeling of discomfort in the epigastrium. In the preceding twenty-four hours had been given one litre of milk and soup, three tumblers of water. No pain on swallowing, no nausea, no vomiting. Four days later, having meanwhile begun to take a mixed diet, had an attack of vomiting which was transient and was not repeated. On the twenty-sixth day, Röntgen examination showed barium meal entering the stomach and the œsophagus almost empty at the end of fifteen minutes. A small barium residue could be seen in the œsophagus, however, as late as ten hours later. She was then able to take a mixed diet without trouble. After expiration of one month she had gained 11 kilograms in weight since the operation and was able to eat all kinds of food without vomiting or gulping. Three months later, she had again begun to vomit and was readmitted to hospital for observation. Œsophagoscopic examination showed the œsophagus just below its commencement to be the subject of a fusiform dilatation which, farther down, became more saccular, which latter condition was maintained to a distance of 39 centimetres from the margin of the teeth. The opening of the œsophagus into the stomach was distinctly visible as a slit about one centimetre in length. A bougie with weighted tip was fairly easily introduced into the stomach, but on withdrawing it, the bougie was rather firmly held at the cardiac orifice as if seized by a certain spasm. The lining mucous membrane is smooth, but the œsophageal wall in the dilated portion is corrugated like a washing-board. A röntgenogram taken one hour after a barium meal showed most of the meal to have entered the stomach. At the end of five hours the stomach was all but empty, there being some residue, however, still present in the œsophagus. For some weeks after this observation her ability to swallow varied, but she continued to increase in weight and was much more comfortable than before her operation. Some days she would vomit once or twice a day, other days she would pass without any vomiting at all. She systematically uses a stomach tube to irrigate the stomach and œsophagus. Last seen, October 15, 1924, when she reported that for several months she had had no trouble in swallowing and that her general condition was excellent.

Case III.—Ingerti; woman, aged forty-six years. Mother of nine children. At ten

years of age had acute rheumatism; at twelve, diphtheria; at fifteen, typhoid fever; six months later, pneumonia. When twenty-one years old began to be troubled by sense of pressure and tightness in her throat when she was eating. This increased until every time after eating one or two mouthfuls she would have marked sense of pressure behind the upper part of the sternum with choking, and after a short while she would regurgitate the food with great force. This thing might happen several times during each meal. Various methods of treatment were unavailing. Finally recourse was had to feeding by stomach tube with nutritive enemata in addition. Some general improvement followed, but there remained always a sense of pressure in her chest. Vomiting spells recurred from time to time, but not several times during each meal as formerly. It was noticeable that food which she had eaten several days before came up again unchanged, while she retained the food that she had eaten last. There developed at this time and has since persisted, pain referred to the back between the shoulders, radiating around the chest like a belt and also upward to the head and downward upon the abdomen. These pains are always present, but varying in intensity. Fast eating aggravates the pains, also violent bodily exertion. Her present mode of eating is as follows: She chews her food just as most people do. The first mouthfuls pass down without trouble, then it gradually becomes difficult to get the food down and a suffocating sensation begins and steadily increases, being localized behind the manubrium sterni. If she goes on eating, a swelling usually appears on the right side and sometimes also on the left side in the neck between the clavicle and the larynx. When she has eaten two half-pieces of bread or a corresponding quantity of other food, she drinks some warm milk or warm water, usually getting up from the table at the same time; having taken several large gulps, she inspires as much air as she can, draws herself up, pulls her shoulders back and strains, and in this manner manages to get the food down, and then the suffocating sensation behind the sternum ceases; then, continuing her meal, the same procedure is repeated again. She experiences no discomfort immediately after meals, but about one-half hour later pains behind the sternum reappear. She then drinks a half-litre of water, and passing down a soft tube to the extent of 37 centimetres, she siphons out the water, always bringing with it plenty of food rests. When she drinks the water at this stage, about one-half hour after meal, she has the sensation of the food being squeezed down into the stomach. Occasionally the tube becomes arrested half way down the œsophagus, but with a little manipulation, as a rule, it slides down without difficulty to the desired length of the 37 centimetres. Immediately upon the meals the patient has palpitations. These disappear when the œsophagus is cleaned out, as does also the sense of pressure behind the sternum, and the patient feels well until her next meal. Between meals she does not vomit and does not chew the cud. By feeding in this manner she has been able to keep her weight up to 53 kilograms during the last thirteen years.

Admitted to hospital September 21, 1920. General condition fair. Pulse, 68; temperature, normal; weight, 48.5 kilograms. X-ray photograph (Fig. 12) shows the œsophagus greatly dilated in its lower two-thirds, forming a large curve towards the right side and backwards, then follows the upper surface of the diaphragm forward and to the left, where it terminates in a pointed offshoot just to the left of the vertebral column. The röntgenogram reveals further a cup-shaped dilatation of the œsophagus behind the upper part of the sternum. This dilatation measures 6 x 3 centimetres in the röntgenogram and is the first portion of the œsophagus to become filled during swallowing while the lower portion is still incompletely filled. As she eats the lower portion of the œsophagus becomes filled more and more, but the interspace between the cap-shaped dilatation in the upper part of the œsophagus and the dilatation in its lower part never becomes quite filled. When she has eaten as much of the opaque meal as she is able, the upper dilatation empties itself through its right corner, producing a narrow streak connecting it with the lower dilatation.

Operation.—September 8, 1922. *Œsophago-gastrostomia subdiaphragmatica.* Morphine, scopolamine, ether narcosis. Marwedel incision. Technic as in previous cases.

Vagi nerves were not seen distinctly. The œsophagus was found considerably dilated and its wall much hypertrophied. The cardia presented a normal appearance. The anastomosis established was of two fingerbreadths. The operation lasted one hour and fifty minutes. Patient stood the interference well. Subsequent course complicated by severe pain in the chest for the first two days. Otherwise recovery uneventful. Wound healed by first intention. On the fourth day water was allowed by mouth, while nutritive enemata were made use of. On the seventh day, 450 grams of soup with claret were administered by mouth and caused neither nausea nor vomiting. When the amount given was increased somewhat, patient complained of slight nausea, but did not vomit and felt that the ingesta slid down into the stomach. At the end of three weeks, patient could tolerate food quite well and was entirely devoid of any feeling that it accumulated in the œsophagus. At the end of six weeks Röntgen examination showed the œsophagus to be still dilated, presenting the S-shaped bend in its lower part, though to a less marked degree than before the operation. The dilatation in the upper part of the œsophagus has disappeared. At the end of fifteen minutes a great portion of the opaque meal had passed into the stomach, but after the lapse of four hours a small rest still remained farthest down in the gullet. Patient was then discharged from the hospital, weighing 49 kilograms.

December 7, 1923, patient wrote: "My weight has increased steadily to 60.4 kilograms. I am not quite rid of the pains in my back between the shoulders and around the ribs on the left side, but they are now much less severe. On one or two occasions I have had some difficulty in swallowing, having felt a spasmodic sensation in my throat and in the upper part of the gullet, but it is soon passed. The feeling of tightness in the chest, hiccough, and risings from the stomach have become more and more infrequent. Nausea occurs now and again, but I have not vomited once. I can eat and drink without worry and I enjoy my food."

April 16, 1923, reported continued well-being. Weight had increased to 63.8 kilograms.

September 8, 1923, reports that the only thing that still persists is a feeling of pressure in her chest above the operation scar. When tired or lying upon her side in sleep sense of nausea and discomfort between her shoulders is sometimes caused. Her appetite is excellent. Weight 65 kilograms. She looks forward to her meals and enjoys a new life. Does not remember to have been so hale and hearty since her youth.

CASE IV.—Olga S., aged thirty-four years. Admitted to hospital January 29, 1923.

History.—Robust as an infant. At six years of age began to throw up repeatedly after meals. As a schoolgirl states that in taking her lunches, she chose solitude because very often she had to vomit and always had to "make such faces" to get her food down. Through her adolescent and adult life this difficulty of swallowing persisted without much change. She learned how to eat so as to be most often spared vomiting. Her statement is that when she had eaten half a plateful of gruel or taken a cup of milk and a piece of bread and butter, she feels that she cannot eat any more, but if she tries to eat more, an attack of vomiting is always provoked. To get food down into the stomach she first drinks two cupfuls of water and then while making powerful efforts at swallowing more water, she makes pressure upon the epigastrium with one hand, inspires deeply, holds her breath and strains hard until she gets red in the face. Meanwhile she stands up and bends backward. At times, while straining, she feels some pain in her back between the shoulder-blades. No particular rumbling is heard when the food passes down. For a short while afterwards she usually feels somewhat languid, but much easier in her chest. A single such straining effort suffices to empty the œsophagus. She then continued her meal, repeating the same process. When at home and able to go through this process of swallowing undisturbed, she gets sufficient food, and there will be long intervals between attacks of vomiting. When away from home and shrinking from executing the complicated manœuvres of getting her food down, she is usually obliged to go out and vomit after a meal. Before going to bed at night, she takes care

to have her "throat empty," either by forcing the food down into the stomach or by bringing it up again. When once she has the food down in the stomach, she tolerates it quite well. No pain after meals; occasionally some slightly sour eructations. She eats all kinds of food. She has borne three children; has never been any worse during the periods of gravidity. She has lost flesh, her weight falling from 50 kilograms formerly to 40.5 at present. Her difficulty of swallowing has increased recently. Her general condition is good; configuration of the abdomen is normal. A semi-rigid œsophageal bougie passes down easily to the length of 44 centimetres. Röntgen examination (barium) shows the œsophagus highly dilated in its lower two-thirds. At the level of the base of the heart, the shadow of the œsophagus has a diameter of between 5 and 6 centimetres. It then forms a convex line towards the right side, the convexity increasing after the œsophagus has reached the diaphragm. (Fig. 15.) The œsophagus then passes forward and towards the left, where a special bulging is seen. Below this, the œsophagus is constricted, its lumen being the size of a finger. This continues for 3 centimetres, where it becomes constricted to the size of a knitting-needle for a length of 5 centimetres more, emptying then into the cardia. Eight hours later (Fig. 17) there is still considerable residue in the œsophagus, which persists in some amount at the end of twenty-four hours. During these Röntgen examinations she was not allowed to resort to her special methods of swallowing.

Œsophagoscopy.—Œsophagoscope easily introduced. Œsophagus throughout almost its entire length is diffusely dilated and changed into a bag-like cavity in which the lower end of the œsophagoscope can be moved several centimetres from side to side and from before backwards. The width of the dilatation decreases as descent is made, and at a point between 37 and 38 centimetres from the margin of the teeth, the end of the œsophagoscope can no longer be moved to and fro. The mucosa is smooth; no hemorrhage nor ulceration; bougie No. 15 easily introduced into the stomach.

Operation.—February 13. *Œsophago-gastrostomia subdiaphragmatica.* Technic as in previous operations. Vagi not severed. Between 6 and 7 centimetres of œsophagus pulled down. Diameter of the pulled-down œsophagus at the œsophageal opening, 3 or 4 centimetres. No particular thickening or constriction of the cardia found. Muscular coat of the mediastinal portion of the œsophagus considerably thickened. Incision into the œsophagus carried down so far that the line of demarcation between the epithelium of the œsophagus and that of the stomach was seen distinctly; no scar, no contraction. Anastomotic opening made large enough to admit two fingers. Duration of operation two hours, twenty minutes. After-course uneventful. First six days nourishment by clyster only. On sixth day, she was given 50 grams of water to drink, which was swallowed without difficulty and retained. On the seventh day given soup and water. The end of second week she was given mixed diet. No trouble in swallowing, no vomiting.

After partaking of a barium meal the œsophagus is practically empty within less than twenty minutes, though at the end of forty-five minutes a distinct residue is seen in the œsophagus. Communication between the œsophagus and stomach the thickness of a finger, demonstrable. One-half hour after giving a Ewald test meal, a tube was passed down to the extent of 42 centimetres without obtaining any food rest. Patient discharged March 17, 1923.

During the months following her return home, she has continued in good health, enjoying undisturbed deglutition. September 11 she reported her weight to be 50 kilograms. She enjoys a good appetite. All of her food enters the stomach.

Case V.—Anna B., aged twenty-six years. Entered the Riks Hospital, October 31, 1923. Always enjoyed good health until sixteen years of age, when, while eating hastily, a piece of meat became impacted in her œsophagus. This was removed through the mouth, but from that time forward she has experienced trouble with swallowing. At first not very troublesome, until three years ago it became manifestly greater, demanding very slow eating; but even when she was very careful, it happened frequently that she found herself unable to swallow and compelled to reject the food. Simultaneously she

has suffered burning sensations in her chest behind the sternum from the cardia upwards. This was relieved by medicinal treatment. Six months ago still greater aggravation in her dysphagia developed. At times the feeling is that her food is arrested at the level of the hyoid bone and then she brings it up immediately. At other times her food seems to get jammed further down just above the cardia. This latter sensation she has never noticed until now. When the food is arrested at the cardia it usually comes up again after a few seconds. If she then continues her meal, food will often pass quite easiiy, but not always. It happens that sometimes the food, after having stopped at the lower end of the gullet, may pass on after the lapse of a few minutes, helped on by drinking water or milk, which enters at the same time with the food previously taken. No movements of the body give any aid in forcing food down. It happens frequently that food eaten in the evening is thrown up in the middle of the night apparently unchanged. She has a constant feeling of food lying in the gullet. Her difficulty of swallowing has some association with her general state of health. When tired, her difficulty of swallowing is more pronounced; when thoroughly rested she can swallow without marked difficulty. The last aggravation of her condition was precipitated when she was very tired and chilled after washing clothes. She has less difficulty in swallowing when she is eating by herself. It is worst when she is with strangers. Her appetite is good; always hungry and thirsty. Has lost weight. She has vomited almost every day after breakfast. Other meals also are frequently disturbed by vomitings. Weight 48 kilograms. Test meals administered after entering hospital were at once rejected. Röntgen examination number one, antero-posterior plane, barium meal. The œsophagus presents spiral-shaped dilatation most marked opposite eighth and ninth dorsal vertebræ. The shadow here has a diameter of 6 centimetres. From this point the œsophagus tapers off as it passes downward to a conical tip at the level of the twelfth vertebra. One-half centimetre to the left of the body of that vertebra the dilated œsophagus forms an arch the convexity of which is directed towards the right and reaches as far as the transverse processes of the eighth and ninth dorsal vertebræ. A large portion of the opaque meal entered the stomach soon after it was eaten. The portion of barium retained in the œsophagus is separated from that in the stomach by a 3 to 4 centimetre broad zone in which small lumps of the barium pap can be seen forming an indistinct connecting link. There is ptosis of the stomach, the lesser curvature being at the level of the umbilicus. At the end of four and one-half hours, there is an average residue in the stomach. Second Röntgen examination made December 6. An ordinary abdominal bougie had passed down to a length of between 60 and 70 centimetres, but was shown by the röntgenogram to have been folded upon itself and to be lying trebled in the dilated œsophagus. The röntgenogram differed from that taken five days previously in that the convexity toward the right side was more pronounced. The narrowing off at the end of the œsophagus begins later and involves only the lower 4 to 5 centimetres of the organ. In this röntgenogram also there is the comparatively empty interspace between the barium shadow in the œsophagus and in the stomach. One-half hour after the barium meal there is a considerable residue still in the œsophagus, which by the end of six hours has nearly entirely disappeared. The œsophagoscope confirms the condition shown by the röntgenogram. When introduced for a distance of 40 centimetres from the margin of the teeth the œsophageal opening is seen closed. Bougie No. 15 can be passed through the cardiac orifice into the stomach, though some force is required to accomplish it. No prominent folds, no ulcerations in the walls of the œsophagus. Owing to the moderate amount of dilatation and of retentions, operation was not proposed at once, but treatment instituted consisting of irrigations of the œsophagus and the introduction into the stomach of bougie No. 15 with the aid of the œsophagoscope. She was also taught to aid swallowing with deep breathing and straining. Under this treatment the amount of food rejected gradually decreased, until after December 2 it ceased altogether. She gained weight to the extent of 4 kilograms while in the hospital. She returned to her home much improved December 21, 1923. Letter dated March 1, 1923, two months later,

reported that she continued in a satisfactory state. No longer vomited; had increased in weight 13 kilograms. Occasionally some difficulty in getting food down, but usually the food passes down quite easily.

Last report from her October 10, 1924, is again having more trouble in swallowing and had lost weight. Good immediate results from dilating the cardia with Gottstein's balloon bougie.

BIBLIOGRAPHY

Alba, A.: Beiträge zur Kenntnis der sogenannt. idiopathischen Œsophagusdilatation. Berl. klin. W., 1917, p. 697.

Andereya: Chronischer Kardiospasmus. Deutsche med. W., 1911, p. 1539.

Anschütz: Verh. der deutsch. Gesell. f. Chirur., 1921.

Baghdassarian, Missak: Cardiospasme idiopathique avec dilatation consecutive de l'œsophage. Thèse, Paris, 1909.

Bard, L.: Le Mégacœsophage. Arch. des maladies de l'appareil digest., etc., 1918, p. 541.

Bard, L.: Note complémentaire sur le mégacœsophag. *Ibidem*, 1919, p. 116.

Bard, L.: Compression tracheale par aërophagie au cœurs d'une dilatation idiopathique de l'œsophage. *Ibidem*, 1920, p. 449.

Bard, L.: Les dilatations idiopathiques des organes tubulés ou cavitaires. Journal de Médicine de Lyon, Avril 5, 1922.

Baudin, Henri: Des dilatations idiopathiques de l'œsophage. Thèse de Paris, 1906.

Baumé: Cit. efter Baudin.

Baumgarten: Deutsche med. W., p. 957.

Bégouin: Cit. efter Goudet.

Bensaude and Guénaux: Contribution à l'étude de la dilatation diffuse et généralisée (dite idiopathique) de l'œsophage. Revue de Médicine, 1921, vol. xxxviii, p. 65.

Berg, C.: Die totale spindelförmige Erweiterung der Speiseröhre und das Wiederkäuen bei Menschen. Inaug. Dissert., Tübingen, 1868.

Berg, John: Nord. kirurg. forenings forhandlinger, 14th Congress, 1923.

Bertolotti and Boidi: Cit. efter Goudet.

Bloch, Oscar: Chirurgien i klin. Forelæsninger, vol. ii, 6, p. 511.

Bonsdorff, Hj. v.: Bidrag till fragan om den operativa behandlingen af Cardiospasmus. Nord. Tidsskrift for terapi, januar, 1906.

Borchgrevink, O.: Nordisk kirurg. for. forhandlinger, 11th Congress, 1916, p. 240.

Borchgrevink, O.: Verhandl. der deutsch. Gesellsch. f. Chir., 1921.

Borchgrevink, O.: Forhandlinger i Med. selskap novbr.–decbr., 1923. *Vide* Norsk Magaz. f. læger.

Boulangier and Digne: Cit. efter Goudet.

Brüning, F.: Ein Beitrag zur Lehre vom Cardiospasmus. Beitr. zur klin. Chir., 1916, vol. xlviii, p. 228.

Brünings, W., and Albrecht, W.: Direkte Endoscopie der Luft- und Speisewege. Neue deutsche Chirurgie, vol. xvi, 1914.

Bull, P.: Nord. kir. forenings forhandl., 14th Congress, 1923. Forhand. i Med. Selskap, novbr.–decbr., 1923. *Vide* N. Magaz. for Lægevidensk.

Chappet: Cit. efter Baudin.

Clairmont: Verh. der deutsch. Gesellsch. f. Chir., 1921.

Coquard: Cit. efter Goudet.

Cordier: Cit. efter Goudet.

Cunéo: Soc. de chir. de Paris, 1922.

Czerny: Verh. der d. Gesellsch. f. Chir., 1907.

Dauber: Ueber spastische Kontraktion der Cardia und ihre Folgezustände. Mitth. aus d. Grenzgeb., 1901, vol. viii, p. 138.

Dave: Cit. efter Baudin.

Davy: Cit. efter Baudin.

Dechaume, Jean: Dilatations dites idiopathiques de l'œsophage. *V.* Renaux, Lyon, 1924. 260 pages.

Della Chiaje: Cit efter Baudin.

Dessecker, C.: Das epiphrenale Pulsionsdivertikel der Speiseröhre. Arch. f. kl. Chir., 1924, vol. cxxviii, p. 236.

Dierling, Hans: Ueber diffuse Dilatation der Speiseröhre. Inaug. Dissert. Rostock, 1910.

Ehret: Kardiospasmus von 16-jähriger Dauer bei einem Soldaten. Münch. m. W., 1916, pp. 920–1031.

Einhorn, Max: Stretching of the Cardia in the Treatment of Cardiospasm and idiopathic Dilatation of the Œsophagus. Americ. J. of the Med. Scien., 1910, vol. cxl, p. 536.

Elsner, Hans: Zur Behandlung des chron. Kardiospasmus. Deut. m. W., 1910, p. 169.

Enderlen: Invagination der vorderen Magenwand in den Œsophagus. Deut. Z. f. klin. Chir., 1903, vol. lxix, p. 60.

Enderlen: Verhandl. d. deut. Ges. f. Chir., 1921.

Ewald, C. A.: Idiopathische spindelförmige Erweiterung der Speiseröhre. Deut. m. W., 1907, p. 1036.

Exner, Alfred: Beiträge zur subphrenischen Œsophago-gastrostomie. Wien. kl. W., 1917, nr. 28, p. 886.

Falkenheim, Curt: Ein Fall von kongenitaler Cardiastenose mit diffuser Œsophagusektasie. Mitthaus Grenzgeb., 1921, p. 113.

Faure: Cit. efter Baudin og Goudet.

Finisterer, H.: Zur Therapie des Kardiospasmus und der Kardiastenose Œsophagogastroanastomose). Wien. kl. W., 1922, nr. 21, p. 471.

Fleiner, W.: Neue Beiträge zur Pathologie des Magens. Ueber die Ursachen und Folgen des sog. Kardiospasmus. Münch. med. W., 1919, p. 979.

Giesse: Cit. efter C. Berg.

Gottstein, Georg: Technik und Klinik der Œsophagoskopie. Mitth. aus Grenzgeb., vol. viii, spec. pp. 99–138.

Gottstein, Georg: Ueber die chir. Behandlung des Cardiospasmus. 76. Versamml. deut. Naturf. u. Ærzte., Breslau, 1904. Ref. i Deut. med. W., 1904, p. 1597.

Goudet, Henri: Le Mégacesophage. Thèse de Lyon, 1919.

Graff: Cardiospasmus. Deut. med. W., 1907, p. 447.

Greffith: Cit. efter Goudet.

Gregersen, Fr.: Ein Fall von sogenannter idiopathischer Œsophagusdilatation. Nord. med. Arkiv. Afd. ii (indre medicin), 1903.

Gregersen, J. P.: Dilatatio œsophagi idiopathica. Ugeskrift for Læger, 1919, pp. 273–82.

Grégoire, Raymond: Méthode permettant d'atteindre le segment cardio-œsophage en évitant la pleure et la péritoine. Soc. de Chir., 1923, nr. 14, og 30, 1924, nr. 15.

Grein: Ein Fall von idiopathischer Œsophagusdilatation. Münch. med. W., 1918, p. 1332.

Grön, Fr.: Med. sels. forhandl. novbr.–decbr., 1923. *Vide* Norsk. Magaz. f. Lægev.

Gröndahl, N. Backer: Cardioplastik ved Cardiospasmus. Nord. kir. for. forhandl. 11 möte, 1916, p. 236.

Gröndahl, N. Backer: Med. selskaps forhandl. novbr.–decbr., 1923. *Vide* N. Magaz. f. læger.

Guérin, Jean: Les ulcéres juxta-cardiaques de l'éstomac. Thèse de Lyon, 1920.

Guisez, Jean: Diagnostique et traitement des rétrécissements de l'œsophage et de la trachée. Masson and Cie, Paris, 1923.

V. Hacker: Verhandl. der d. Ges. f. Chir., 1907.

Hærem, H.: Diffus dilatation av œsophagus uden anatomisk stenose (cardiospasmus). N. Mag. f. Lægev., 1909, p. 1190.

Hald, P. Teteus: Tilfælde av idiopathisk diffus dilatation af Spiseröret. Med Demonstration av Præparat. Ugeskrift for Læger, 1911, p. 894.

Hall, H. C.: Cardiospasme med. dilatation av œsophagus. Ugeskrift for Læger, 1915, p. 519.

Handfort: Cit. efter Goudet.

Hanney: Cit. efter Stern.
Hansen, P. N.: Et tilfælde av saakaldt idiopathisk Œsophagusdilatation. Hospitalstidende, 1916, p. 1177.
Hansen, P. N.: Nord. kir. firenings forhandlinger, 1916.
Harbitz, Francis: Idiopathisk œsofagusdilatation. Norsk Mag. f. Lægev., 1918, nr. 8.
Harbitz, Francis: Med. selskaps forhandl. novbr.–decbr., 1923. *Vide* Norsk. Mag. f. Lægev.
Heissler, August: Primärer Cardiospasmus nach Trauma, etc. Grenzgeb., vol. xx, 1909, p. 831.
Heller, E.: Extramuköse Cardioplastik beim chronischen Cardiospasmus mit Dilatation des Œsophagus. Grenzgeb., vol. xxvii, H. 1.
Heller, E.: Verhandl. der d. Ge. f. Chir., 1913, 1914, og 1921.
Helm, Friedrich: Seltene Röntgenbilder des Œsophagus. Mediz. Klinik, 1918, p. 666.
Hertz, A. F.: Royal Society Decbr., 1914. Brit. Med. J., 1914, vol. ii, p. 1062.
Hertz, F., et Braine, J.: Phrénospasme. Elargissement de l'orifice diaphragmatique de l'œsophage. Œsophagoplastic par voie thoraco-abdominale extraséreuse. Soc. de Chir. de Paris, 1924, nr. 15, p. 569.
Heyrovsky, Hans: Casuistik und Therapie der idiopathischen Dilatation der Speiseröhre. Œsophago-gastroanastomose. Arch. f. klin. Chir., vol. c, p. 703.
Heyrovsky, Hans: Verh. der d. Gesell. f. Chir., 1911.
Hiekens, Peverell S.: A Peculiar Case of Œsophageal Dilatation. Brit. Med. J., 17/2, 1912, p. 360.
Hirsch, Alfred: Zur Kenntnis der diffusen Speiseröhrenerweiterung durch chron. Kardiospasmus. Münc. med. W., 1919, p. 1149.
Hirsch, Paul: Zur Pathologie der diffusen Œsophagusdilatation. Berl. klin. W., 1920, p. 494.
Hirschsprung: Stuhlträgheit Neugeborener in Folge von Dilatation und Hypertr. des Colons. Jahrb. f. Kinderh. k., 1888, vol. xxvii, p. 1.
Holst, P. F.: Med. selsk. forhandl. novbr.–decbr., 1923. *Vide* N. Mag. f. Lægev.
Hunnelinau: Die diffuse Dilatation der Speiseröhre in Röntgenbilde. Berl. med. Ges. 16/5, 1917. Berl. kl. W., 1917, p. 566.
Huss, M.: Hygiea 1842, nr. 6, p. 206.
Hysen, Johs: Œsophagospasme. Daush Virurg. Selskales Vorhandl., 8-xii, 1923. Hospitalstidunde, 1924, nov. 31.
Jaffé, K.: Ueber idiopathische Œsophaguserweiterungen. Münch. med. W., 1897, p. 386.
Johnsson, E. G.: Likformig dilatation av œsophagus, beroende paa en under lifvet befintlig striktur i cardia, sannolikt av nervöst ursprung. Hygiea 10. oktbr, 1895.
Kappis, Max: Das Ulcum peptic. œsophagi. Mitth. aus Grenzg., 1910, vol. xxi, p. 746.
Karewsky: Deutsche med. W., 1899 (Vereinsbeilage, p. 185).
Kelling: Cit. efter Baudin.
Key, E.: Nord. kir. forenings forh., 14. möte, 1923.
Kramer-Petersen: Om Kardiospasme. Ugeskrift for Læger, 1908, nr. 49, p. 1401.
Kraus: Nothnagels Handb. der spec. Path. u. Therapie, 1902, vol. iii.
Krause, P.: Röntgendiagnostik der Erkrankungen der Speiseröhre und des Magens. Ref. i D. m. W., 1914, p. 309.
Kümmel, Hermann: Zur Operation des Kardiospasmus und des Œsophaguscarcinoms. Verh. d. d. Ges. f. Chir., 1921, p. 327.
Lambert, V. S.: Surgery, Gynæcology and Obstetrics, Jan., 1914.
Lardennois, George, and Jean Braine: Phrénospasme chronique lié à un ulcus gastriques juxta-cardiaque. Débridement de l'orifice diaphragmatique. Guérison de la dysphagie. Soc. de chir. de Paris, 1923, nr. 22, p. 937.
Lecène, P.: Stenose inflammatoire avec spasme du cardia-dilatation œsophagienne considérable. Cardioplastic. Guérison. Soc. de chir. de Paris, 1919, p. 710.
Lecène, P.: *Ibidem*, 1924, nr. 15, p. 374.
Leegaard, F.: Med. selsk. forhandlinger novbr.–decbr., 1923. *Vide* N. Mag. f. Lægev.

Leffler, J.: Fysikalska Kavernsymptom vid fall av œsofageal pulsionsdivertikel jämte idiopathisk œsophagusekaasi. Hygiea, 1917, p. 748.

Lefmann, G.: Die Behandlung des Kardiospasmus. Verh. des 29, deut. Kongr. f. innere Med., 1912, p. 692.

Leichtenstern, Otto: Enorme sackartige Erweiterung des Œsophagus ohne mechanische Stenose desselben in einem Falle von 7-jährigem, hysterischem Erbrechen. Deut. med. W., 1891.

Létulle and Meslay: Cit. efter Goudet.

Liébault, Georges: Les stenoses inflammatoires chroniques de la région cardiaque de l'œhophage. Thèse de Bordeaux, 1913.

Lindau: Cit. efter Baudin.

Lindström, Erik: Fall av kardiospasme med œsophagusdilatation. Hygiea 1918, vol. lxxx, p. 1169.

Lindström, Erik: Nord. kir. forenings forhandl. 14th Congress, 1923.

Lindvall, Hermann: Fall av diffus œsophagusdilatation kombineret med asthma bronchiale. Hygiea 1915, p. 860.

Litten: Deut. m. W., 1899, Vereinsbeilage, p. 185.

Lockwood, C. B.: Case of (so-called) idiopathic dilatation of the œsophagus. Brit. Med. J., 1903, June, p. 1367.

Lossen, J.: Ueber die idiopathische Erweiterung des Œsophagus. Mitth. a. Grenzgeb., 1903, vol. xii, p. 331.

Luschka, H. v.: Die spindelförmige Erweiterung der Speiseröhre. Virch. Arch., vol. xlii, 1868, p. 473.

Luschka, H. v.: Das Antrum cardiacum des Menschl. Magens. Virch. Arch., vol. xi, 1857, p. 427.

Madsen, Edgar: Kardiospasme-Dilatatio œsophagi. Ugeskrift for Læger, 1916, p. 947.

Martin, E.: Zur chirurgischen Behandlung des Cardiospasmus und der spindelförmigen Speiseröhrenerweiterung. Mitth. a. Grenzg., 1901, vol. viii, p. 226.

Martin, E.: Verh. d. Gesell. f. Chirurgie, 1907.

Meltzer, S. G.: Ein Fall von Dysphagie nebst Bemerkungen. Berl. klin. W., 1888, pp. 140–173.

Meyer, Hermann: Enstehung und Behandlung der Speiseröhrenerweiterung und des Cardiospasmus. Mitth. a. Grenzgeb., 1922, p. 484.

Mikulicz, f. v.: Zur Pathologie und Therapie des Cardiospasmus. D. med. W., 1904, pp. 17–50.

Mikulicz, f. v.: Beiträge zur Physiologie der Speiseröhre und der Cardia. Mitth. a. Grenzg., vol. xii, p. 569.

Monakow: Cit. efter Baudin.

Mondière, J. T.: Recherches sur l'œsophagisme ou spasme de l'œsophage. Arch. générales de méd. II. Serie, t. i. p., 465.

Monrad, S.: Tre tilfælde av hysterisk Œsophagusspasme. Ugeskr. f. Læger, 1918, 26 sepbr.

Monro, Alexander: The Morbid Anatomy of the Human Gullet, Stomach, and Intestines. Edinburgh, 1811. Spasm of the Gullet, p. 223. Pulsy of the Gullet, p. 229.

Mosher, H. P.: Liver Tunnel and Cardiospasm. Laryngoscope, 1922, ref. i Journ. of Americ. Med. Assoc., 1922, vol. ii, p. 241.

Mouchet: Soc. de chir. de Paris, 1922.

Nicolaysen, Knud: Patholog.-anatom. u. experim. Studien über die Pathogenese des chron. Magengeschwürs. D. Z. f. Chir., vol. clxvii.

Nicolaysen, Knud: Med. selsk. forh. novbr.–decbr., 1923. *Vide* N. Mag. f. gev.

Nordentoft: Nord. kir. forenings forh. 11th Congress, 1916.

Œttinger, W., et Caballero, R. V.: De la dilatation idiopathique de l'œsophage ou mégaœsophage. Anniv. des Maladies de l'appareil digest., etc., vol. xi, nr. 6, 1921, p. 369.

Œttinger, W., et Caballero, R. V.: À propos de mégacœsophage. *Ibid.*, 1922, vol. xii, nr. 4, p. 274.

Palugyay, Josef: Die Œsophago-Gastro-Anastomose nach Heyrovsky im Röntgenbild. Ein Beitrag zum funktionellem Verhalten der Speiseröhre und des Magens nach der Operation. Arch. f. kl. Chir., 1923, vol. cxxv, H. 3, p. 554.

Pamperl, Robert: Zur operativen Behandlung des Kardiospasmus. Zeit. f. klin. Chir., 1919, vol. cxlviii, p. 206.

Payr, E.: Verh. der d. Ges. f. Chir., 1921.

Poirier: Traité d'anatomie humaine, t. iv.

Prat, D.: Deux cas de mégacœsophage. Soc. de Chir. de Paris, 1924, nr. 13, p. 519.

Pribram: Verh. der d. Ges. f. Chir., 1921.

Purton: Cir. efter Baudin.

Reinhardt: Ungewöhnlich starke Dilatation und Hypertrophie des Œsophagus infolge sogen. Kardiospasmus; Kombination mit Karzinom. Münc. med. W., 1919, p. 1210.

Reisinger: Verh. der d. Ges. f. Chir., 1907.

Richartz, H.: Ueber die Differentialdiagnose zwischen spindelförmiger Erweiterung und tiefzitzendem Divertikel des Œsophagus. Deut. med. W., 1904, pp. 732 u. 775.

Roepke: Verh. der d. Ges. f. Chir., 1913, 1914 u. 1921.

Rokitansky: Cit. efter Stern.

Rosenheim, Th.: Ueber Spasmus und Atonie der Speiseröhre. Deut. med. W., 1899, nr. 45, 46, 47.

Rovsing, Th.: Et Tilfælde av total Gastroptose med Dilatation af Speiseröret. Hospitalstidende, 1913, pp. 1–11.

Rovsing, Th.: Demonstration af en Patient med Diverticulum œsophagi.

Rovsing, Th.: Demonstration af en Patient med Ektasia œsophagi. (Congenita idiopathica.) Dansk kir. Selskab 18/11, 1911, Hospitalstidende, 1912, p. 125.

Rovsing, Th.: Nord. kir. forenings forhandl., 14th Congress, 1923.

Rumpel: Die klin. Diagnose der spindelförmigen Speiseröhrenerweiterung. Münc. med. W., 1897, pp. 383 u. 420.

Rumpel: Œsophagus mit gleichmässiger, idiopathischer Erweiterung. Ref. i D. m. W. Vereinsbeilage, 1899, p. 289.

Russel, J. C.: Diagnosis and Treatment of Spasmodic Stricture of the Œsophagus. Brit. Med. J., 1898, p. 1450.

Sandberg, Otto: Om idiopathisk spolformig utvigning av matstrupen. Hygiea, Sepbr., 1899.

Sargnon, A.: Le Mégacœsophage. Le Journal de Médicine de Lyon. 5 mars, 1921, p. 779.

Sargnon, A.: Congrès de la Société francaise d'Oto-rhino-laryngologie, 1921.

Sargnon, A.: Quelques considérations sur l'anatomie, la physiologie et l'exploration clinique de l'œsophage normale et pathologique. Journ. de Médicine de Lyon. 5 Oct., 1922.

Sargnon, A., et Arcelin: Dilatation de l'œsophage. Lyon médicale, 1911, nr. 4.

Sargnon, A., Pétru and Gaillard: Mégasophage observé chez un enfant de 12 ans. Lyon méd., 1924, nr. 19.

Sauerbruch: Kardiospasmus, Plastik. Münch. m. W., 1920, p. 224.

Sauerbruch: Verh. der d. Ges. f. Chir., 1921.

Schaldemose, V.: Operert Tilfælde af idiopathisk Œsophagusdilatation. Nord. kir. foren. forhandl. 11th Congress, 1916, p. 231.

Schilling, Hj.: Med. selsk. forhandlinger, novbr.–decbr., 1923. *Vide* N. Mag. f. lægev.

Schmitt: Cit. efter Baudin.

Schnitzler, J.: Subphrenische Œsophagostomie wegen Kardiospasmus. Wien. kl. W., 1918, p. 768.

Schreiber, Julius: Zur experimentellen Pathologie und Chirurgie des Schluckapparates (Œsophagoplastik). Mitth. a. Grenzgeb., vol. xxiv, p. 356.

Schultze, J.: Röntgenbeobachtung über funktionelles Verhalten des Œsophagus. Berl. kl. W., 1917, p. 1013.

Sébileau: Soc. de Chir. de Paris, 1922.

Sencert et Simon: Le traitement opératoire de la dilatation idiopathique de l'œsophage. Revue de Chirurgie, 1921, vol. lix, p. 355.

Shaw, H. Batty, and Woo, A. W.: Six Cases of Œsophagectasia. Lancet, Decbr. 2, 1916.

Shaw, H. Batty, and Woo, A. W.: A Case of Extreme Œsophagectasia. Lancet, Nvbr. 22, 1919, p. 923.

Sievers, R.: Zur Kenntnis der idiopathischen Œsophaguserweiterung. Verh. des 4. nord. Kongresses f. innere Mediz., Helsingfors, 1902.

Smithies, Frank: Diagnosis and Clinical Manifestations of Cardiospasm Associated with Diffuse Dilatation of the Œsophagus. Americ. Journ. of Medic. Sciences, 1921, vol. clxii, p. 313.

Snodgrass, T. J.: Case of Cardiospasm with Enormous Dilatation of Œsophagus. Ref. i. J. of Americ. Med. Assoc., 1921, vol. ii, p. 230.

Souligoux: Soc. de chir. de Paris, 1922.

Spengler: Cit. efter Stern.

Starck, Hugo: Zur Pathologie der Erweiterungen der Speiseröhre mit besonderer Berücksichtigung des Röntgenverfahrens. Verh. des 29 Kongr. f. innere Med., 1912.

Stark, Hugo: Œsophagoskopie. Handbuch der spec. Chirurgie des Ohres und der oberen Luftwege., vol. iv, p. 602, 1913.

Stern, Silvius: Ein Fall gleichmäsziger Erweiterung des Œsophagus. Arch. f. Heilkunde, 1876, p. 432.

Stierlin, Reinhold: Ueber diffuse Œsophagusektasie bei wahrscheinlich angeborener Cardiastenose. Baumgartens Arbeit. auf dem Gebiet der path. Anat. u. Bakter. Vol. vii, 1911, p. 19.

Straus, H.: Demonstration eines Präparates von "sogenannter idiopathischer Œsophagusdilatation" ("sackförmige Speiseröhrenerweiterung ohne anat. Stenose"). Verh. des Congr. f. innere Med., Berlin, 1901, p. 533.

Strümpel, Adolf: Spindelförmige Erweiterung des Œsophagus ohne nachweisliche Stenosenbildung. Arch. f. klin. Med., 1881, vol. xxix, p. 211.

Thesen, J.: 2 tilfælder av cardiospasmus. Demonstration. Med. selsk. forhandlinger, 1911, p. 6. *Vide* N. Mag. f. lægev.

Thesen, J.: *Ibidem*, novbr.–decbr., 1923. *Vide* N. Mag. f. lægev.

Thieding, Friedrich: Ueber Cardiospasmus, Atonie und "idiopathische" Dilatation der Speiseröhre. Br. Beitr. z. klin. Chir., vol. cxxi, pp. 237–300.

Trechtchenkow, Nadéjda: Contribution à l'étude de cardiospasme. Thèse de Paris, 1913.

Troell, Abraham: Nord. kir. forenings forh. 14th Congress, 1923.

Tuffier: Dilatation permanente de l'œsophage avec oblitération intermittente du cardia. Disparition presque totale des accidents sans intervention. Soc. de chir. de Paris, 1922, p. 413.

Tuffier: Dilatation de l'œsophage. Mégaœsophage. Opération. Resultat fonctionel suivi sur radiographie, huit mois après. *Ibidem.*, 1922, p. 446.

Uchermann, V.: Med. selsk. forhandl., novbr.–decbr., 1923. *Vide* Norsk Mag. f. Lægev.

Weber, Parkes: Spasmodic Stricture of the Œsophagus. Brit. Med. J., 1914, vol. i.

Weitz, Eugen: Sechs Fälle von Œsophaguserweiterungen. Fortschr. auf d. Geb. der Röntgenstr., vol. xxiii, p. 395.

Wendel, W.: Zur Chirurgie des Œsophagus. Verh. d. deut. Ges. f. Chir., 1910, p. 588.

Wendel, W.: *Ibidem*, 1921.

Wibrecht: Cit. efter Baudin.

Wilks: Cit. efter O. Berg.

Wilms: Dauerspasmus an Pylorus, Cardia, Sphincter der Blase und des Mastdarms. Zeitschr. f. klin. Chir., vol. cxliv, 1918, p. 67.

Zaajer: Cardiospasmus. Ref. i, Centralbl. f. Chir., 1919, p. 57.

Zenker and Ziemssen: Handbuch der speciellen Pathol. u. Therapie, vol. vii, p. 1, 1877.

A SUGGESTION FOR THE RELIEF FOR THE PAIN FROM CARCINOMA OF THE MOUTH AND CHEEK*

By Francis C. Grant, M.D.
of Philadelphia, Pa.

There is a no more pitiful class of cases to deal with than those suffering from malignant disease about the mouth and cheek. Aside from the discomfort they endure from a sloughing surface about the mouth, foul breath, constant salivation, interference with eating, the involvement of the peripheral branches of the fifth nerve often produces severe, constant pain. Operative procedures, whether to remove the growth or plastic surgery to repair the defects caused by the wide removal of malignant tissue, and the necessary wound dressings, all add to the sum total of the suffering to be endured. When one adds the constant pain from the growth itself to the apprehension felt by the patient who knows that he has a cancer and fears for his life, it is little wonder that the sufferer's morale is broken down, he dreads further treatment and feels that an easy death would be a joyful relief. It is in an endeavor to make the suffering less intense and to relieve at least in part the pain caused by the growth or the manipulations necessary to dress or repair the wounds made in its removal, that we suggest injections of alcohol into the second or third divisions of the trigeminus, intracranial neurectomy of the second and third divisions of this nerve or avulsion of its sensory root behind its ganglion. Of these procedures we prefer intracranial neurectomy. If operation seems contra-indicated or is refused, deep alcoholic injection of the three divisions of the trigeminal is the procedure of choice. The technic, which we have described elsewhere,[1] is simple. The anæsthesia following a successful deep injection will continue for at least a year, which is longer than the life expectation in most of these cases. If the growth is extensive

Fig. 1.—Case rendered pain-free showing position and type of lesion present. Injection second and third divisions of fifth nerve.

* Read before the Philadelphia Academy of Surgery, November 3, 1924.

enough to involve the nerve root to be injected, the position of the nerve trunk will be changed and the injecting needle may not reach the nerve. Avulsion of the sensory root is only indicated in cases in which the supraorbital or first division of the trigeminus is involved. Intracranial neurectomy of the second and third divisions produces the necessary anæsthesia, is a simpler and more rapid operation, and because it spares the supraorbital branch, avoids any possibility of corneal complications in the eye on the operated side. Intracranial neurectomy may be performed under local anæsthesia without undue discomfort to the patient, if the mouth condition seems to contra-indicate the administration of ether.

FIG. 2.—Case rendered pain-free showing position and type of lesion present. Intracranial neurectomy second and third divisions of fifth nerve.

The degree of relief to be anticipated following any of these procedures depends on the situation of the growth causing the pain. If the lesion be located within the distribution of the second and third divisions on the cheek, upper or lower lip, nose, tongue, or floor of the mouth, anterior to the anterior fauces, complete relief may be anticipated. The sensory distribution of the third division is much higher externally on the cheek than is usually supposed. If the growth extends below the line of the lower jaw, the cervical nerve distribution is implicated. This pain is not relieved by blocking the trigeminus. A resection of the superficial cervical branches below the lower jaw may be done if this pain remains. Among the distressing complaints that afflicts these sufferers is pain deep in and behind the ear, and the pain produced by the act of swallowing. Against this we are helpless. No nerve resection which we can do will relieve this pain deep in the auditory canal or in the throat. But in spite of this fact we can do much by nerve blocking to make these patients comfortable, prevent the constant need for morphine, raise their morale, and improve their outlook on life.

This report is based on a series of twenty-seven cases. In every case except two, the malignancy involved the skin or mucous membrane about the mouth and cheeks. In two cases the maxillary antrum and posterior ethmoid cells were the seat of the growth. (See table for details of location of neoplasm.) Twenty cases were injected, seven were operated upon.

Of the twenty cases receiving deep alcoholic injections, ten were completely

relieved of the pain, seven were improved, and three we were unable to benefit. The third division was injected on sixteen occasions, eight with success, five with partial improvement and three with no improvement. The second and third divisions were injected at the same sitting four times, twice with complete

TABLE I

Summary of Results Showing Position of Growth and Method of Treatment

Location of growth	No. of cases	Treatment	Result
Maxillary antrum and upper jaw.	4	Alc. inj. III	Pain relieved.
		Avuls. sens. rt.	Pain relieved. — Died meningitis, 10 days.
		Alc. inj. II and III	Pain relieved.
		Avuls. sens. rt.	Pain relieved.
Post. ethmoid cells and maxillary antrum.	1	Avuls. sens. rt.	Pain relieved, 60 per cent.
Superior maxilla.	3	Alc. inj. II and III	Pain relieved.
		Alc. inj. II and III	Pain relieved, 50 per cent.
		Alc. inj. III	Pain relieved.
Cheek — skin	3	Avuls. sens. rt.	Pain relieved.
		Avuls. sens. rt.	Pain relieved.
		Intracranial neurectomy II and III	Pain relieved.
Cheek — mucous membr.	1	Alc. inj. III	Pain relieved, 60 per cent.
Tongue.	4	Alc. inj. III	Pain relieved.
		Alc. inj. III	Pain relieved.
		Alc. inj. III	Pain relieved.
		Alc. inj. III	Pain relieved.
Inferior maxilla.	4	Alc. inj. III	Pain relieved.
		Alc. inj. II and III	Pain relieved.
		Alc. inj. III	Pain relieved.
		Alc. inj. III	Pain relieved.
Tongue and floor of mouth.	6	Alc. inj. III	Pain not relieved.
		Alc. inj. III	Pain relieved.
		Avuls. sens. rt.	Pain not relieved.
		Alc. inj. III	Pain not relieved.
		Alc. inj. III	Pain not relieved.
		Alc. inj. III	Pain relieved, 50 per cent.

relief, twice producing an amelioration of the pain. In the three cases that were not relieved the growth had involved the floor of the mouth and the tonsil. The act of swallowing was painful. Pain deep in the ear was a distressing feature. In these three cases we were unable to inject alcohol directly into the nerve sheath. The novocain used for the injection produced

a temporary peripheral anæsthesia, disappearing in twenty-four hours and failing to relieve their suffering. In those cases considered improved the pain in the jaws, cheeks or tongue has been relieved. This pain is often so severe that it masks and overshadows lesser pain felt in the throat on swallowing or in the ear. After the major suffering is relieved by injection the lesser pain remains. If the spread of the growth is not checked before death brings relief, this pain in throat and ear may easily reduce the sufferer to the same state of demoralization as he had reached before the nerve blocking rescued him.

Of the seven much improved cases, four died without much discomfort within eight months. One committed suicide when the cancer spread to the other side of his face and caused pain there, and two are receiving treatment without requiring opium to control their suffering.

FIG. 3.—Case rendered pain-free showing position and type of lesion present. Intracranial neurectomy second and third divisions of fifth nerve.

Among the ten cases completely relieved, five died peacefully from metastasis within eighteen months following injection. Three are pain-free and receiving treatment. Two are apparently cured twenty-four and thirty months after injection. In one case in which the relief of pain was complete an extensive fulguration of a growth of the jaw and tongue was carried through without any anæsthesia. There has been no recurrence after removal. With this particular type of lesion, small, painful, but with a fair chance of complete removal if vigorous treatment is instituted, nerve blocking is especially valuable. If the pain is relieved, and if treatments and dressings are not an agony to the patient, he will undergo them much more readily. Once the lesion is healed the pain disappears. If subsequently the anæsthesia from the injection wears off, it has done its work and the face regains its normal sensation.

In seven cases the major operation was performed, twice with intracranial neurectomy of the second and third divisions, five times with avulsion of the sensory root of the trigeminus behind the Gasserian ganglion. Two cases are still alive and free from pain. One case was pain-free for eighteen months when he succumbed to metastases. One case was pain-free for eight months, then developed pain in the neck and ear, which continued for two months

until death. The fifth case developed a meningitis, due apparently to an intracranial extension of a carcinoma of the antrum, five days after operation and died. His suffering was completely relieved during the ten days he survived. The sixth case, again with an intracranial extension of a carcinoma of the ethmoid cells, which involved the Gasserian ganglion, showed only partial relief. The last case had marked involvement of the floor of the mouth and tonsil as well as tongue, inferior maxillary bone and cheek. While the pain in the jaw and tongue ceased, that in throat and ear remained. The first week after operation he seemed improved. Subsequently he complained more bitterly over the pain in his throat and ear than he had about the pain in his mouth. His condition was in no way bettered.

FIG. 4.—Case rendered pain-free showing position and type of lesion present. Intracranial neurectomy second and third divisions of fifth nerve.

Prior to injection all these sufferers had been receiving large doses of morphine in an attempt to keep them comfortable. One had received as high as four grains a day. Within ten days of relief of pain following intracranial neurectomy he was free from the need for the drug. One case of carcinoma of the floor of the mouth and side of the tongue had had no sleep for six days and nights. We injected him successfully at noon and he slept soundly on the operating table for the next six hours. These sufferers after relief are the most grateful class of patients which we meet. It is the constant gnawing pain, without recession or let up, day or night, which wears down their nerve and stamina and causes them to turn to opiates for relief. And many cases, even if the carcinoma is controlled, are still drug addicts. Relief of pain by successful injection prevents this misfortune.

Nerve blocking of the branches of the trigeminus for the relief of pain from cancerous lesions about the face is an act of mercy. It does not cure the lesion. Often that is impossible. But it makes the sufferers last days comfortable. If a man or woman is doomed to die from cancer of the face—and it is a slow, lingering, miserable way to perish—it is cruel for us to deny them any treatment that may ease them on their way and relieve even a part of their anguish.

REFERENCE

[1] J. A. M. A., vol. lxxviii, p. 794, March 18, 1922 and vol. lxxviii, p. 1780, June 10, 1922.

KIDNEY GUMMATA

By Tetsuzo Aoyama, M.D.
of Tokio, Japan

Gummata in the kidney are found in very exceptional cases, in acquired as well as congenital syphilis. Such gummata have been found in a number of autopsies. In a few cases the diseased kidneys had been removed, the majority with the diagnosis of suspected malignant neoplasm. Israel reported as example two cases of the removal of gummatous kidneys; in one of these cases the author could not determine its nature before the operation, believing it to be a neoplasm at the operation.

The following case was suspected also at the operation to be a neoplasm, and a very extensive operation was performed. Fortunately the patient recovered from the operation and is now after four years since the operation completely well.

A woman, forty-nine years old. No family history of cancer. Married with a healthy man; six children, no miscarriage. Till the first birth, menstruation irregular, but thereafter became regular. She was very well till the onset of the present disease. Venereal diseases negative. Before four years she had an attack of pain in the left hypochondrium where a mass was found at that time. Since that time the attacks of pain occurred frequently, especially after voluminous eating. Last month felt fever and fatigue. In the meantime again severe pain in the abdomen. The abdomen distended and became tender. No remarkable change in the size of the tumor since its detection.

On admission poorly nourished. Arteries sclerotic. A few lymphatic glands palpable in both axillæ, but not anywhere enlarged. Examination of the heart negative, râles detected over both lungs. In the left hypochondrium a mass was found readily palpable bimanually. Its form is nearly oval. The apex of the tumor is hidden behind the costal arch and cannot be palpated. The size of the palpable mass is about that of a goose egg. The outside of the tumor is smooth and clearly bounded. The median side is not so clearly bounded. The lateral half with smooth surface, but median half nodular. The mass moves with respiration, is very hard. The dulness of spleen is normally situated and not enlarged. On the skin of left half of abdomen some dilated veins are visible.

The examination by inflation of the colon showed the retroperitoneal position of the tumor, by the inflation of the stomach the tumor moves somewhat downwards. Gastric contents after test breakfast: total acidity 26, free hydrochloric acid 12, Uffelmann's reaction positive.

Daily quantity of the urine between 1500 and 2500, its color yellowish, somewhat cloudy, specific gravity 1005–1015, slightly alkaline, albumin slight, free from sugar. Microscopic examination reveals a few epithelial cells, but no cast.

The nature of this kidney-tumor could not be determined.

Operation—June 11, 1920. General anæsthesia. By the lumbar oblique incision the left kidney exposed. The fat capsule showed no remarkable pathological change, separated easily from the proper capsule, but at the upper pole and the hilum it was infiltrated very hard. A transverse incision from the middle point of the oblique incision through the anterior abdominal wall to the middle line added and the peritoneal cavity opened widely, revealed better the exact features of the region. The infiltrated mass

at the hilum and the upper pole of the kidney was adherent with the lower surface of the spleen. The tail of the pancreas was imbedded in the mass and the splenic flexure of the colon for about 5 cm. long was firmly adherent. The conglomerate of these several organs was movable against the posterior wall of the abdomen. The largest part of the kidney had been separated already from the lumbar route. Now the hilum of the spleen was ligated and divided; then the tail of the pancreas was amputated at the healthy part after dividing and ligating in a few portions; the cut end of the pancreas not being especially cared for. The excision of the adherent flexure of the colon followed, the cut ends of the colon being sutured end-to-end. The mass which was composed of kidney, spleen, a part of pancreas and colon, was completely removed. The wound was closed with suture and a drain of iodoform gauze left in place.

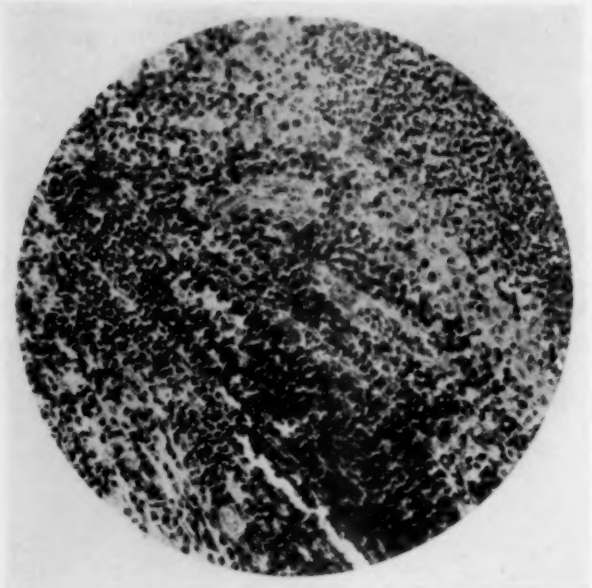

FIG. 1.—Gummatous area in the kidney.

The time of the operation about two hours. After the operation the patient showed collapse, but recovered after intravenous infusion.

June 13, abdomen distended and tender. In the night the patient was in danger. Injection of camphor-oil every three hours.

June 14, afternoon, the pulse recovered. The distention of the abdomen diminished. After this time no more in danger.

The secretion from the drainage opening was abundant in the first week. The secretion had a peculiarly irritating odor. But the secretion diminished gradually so that at the end of the second week there was very little, and July 13, 1920, was discharged with a small fistula.

On the third and fourth day after the operation tests for the ferments of the pancreas in the urine were made, but were negative. The secretion of the wound was not tested.

June 24, 1920, ten days after the operation, blood examination revealed red corpuscles 4,500,000, leucocytes 12,500, hæmoglobin 71 per cent. July 1, 1920, red corpuscles 5,010,000, leucocytes 20,000, hæmoglobin 74 per cent.

After the operation the Wassermann test gave a positive result.

Macroscopical Description of the Specimen.—The mass composed by the kidney, the spleen, a part of the pancreas and a piece of the colon. The kidney enlarged, the length 13 cm., width 7 cm., thickness 6.6 cm. It has nearly the proper form of the kidney, but the upper half is larger, especially its anterior surface shows semispheric protrusion. The upper pole of the kidney is flattened, on which the spleen is adherent. The outline of the kidney is smooth. The proper capsule strips off easily, but on the hilum and the upper part it is firmly adherent with the parenchyma. The peri- and para-renal tissue on the hilum and the upper part of the kidney is indurated very hard. With this infiltration the lower pole of the spleen, the tail of the pancreas and the splenic flexure of the colon adherent.

The spleen is somewhat enlarged, the length 11 cm., width 8 cm., thickness 3.5 cm., the surface smooth, the consistence increased.

The removed part of the pancreas is 4 cm. long, the consistence is increased evidently. The lobulated structure is not clear.

The resected piece of the colon, 12 cm. long, is adherent in 5 cm. length with the infiltrated tissue on the hilum of the kidney. The mucous membrane shows no change.

On section the kidney is generally anæmic. The normal structure is extremely destroyed. The borderline between the cortex and the medulla is not clear. The physiological structure of the medulla is destroyed almost completely, its larger part is substituted by partly grayish fibrous, partly yellowish diseased areas. The yellowish diseased areas rather more or less localized. The cortex is diseased likewise, but to a lesser degree. In the upper anterior part of the kidney, where its surface semispheric protrudes, reveals a sharply localized gummatous nodule as large as a cherry. Its centre shows necrosis.

Pelvis and its tributaries are narrowed and on section only two papillæ remained, all the others destroyed.

The ureter is in the beginning as large as a pencil, the wall thickened.

The spleen shows on section no remarkable change. On the largest part, which is adherent to the kidney, the fibrous capsule remained. But in a small portion the infiltration had invaded about one cm. into the tissue of the spleen. The pathological tissue which connects the spleen and the kidney is about one cm. thick, seems densely fibrous, is scattered with pinhead large yellowish areas.

Minute change: Microscopic examination Fig. 1, shows that the renal parenchyma is substituted widely by dense fibrous tissue, which is scattered with areas of accumulation of the plasma-cells. The areas of the plasma-cells are in a few places rather extensive and its centre shows necrosis. The intima of the blood-vessels in places thickened and in other places the lumen is completely obliterated. The epithelial cells of tubule are degenerated and destroyed. The glomeruli are extremely diminished, its capsule thickened.

PERIRENAL HYDRONEPHROSIS*

WITH COMMENTS ON THE TECHNIC OF ABDOMINAL EXTRAPERITONEAL NEPHRECTOMY

By Benjamin Lipshutz, M.D.

of Philadelphia, Pa.

assistant surgeon, mt. sinai hospital

In 1906, Minkowski and Friedrich described under the title of "Perirenal Hydronephrosis," a kidney surrounded by a large serous cyst, which enveloped the organ as if formed of a parietal and visceral layer, the kidney lying in a sac in a manner similar to the testis in a hydrocele of the tunica vaginalis. The cyst presented no demonstrable communication with the urinary tract (pelvis or ureter).

The Swedish School of Surgery has labeled this type of cyst of the kidney "hydrocele renis." Connerth, in describing his case, designates it as a hygroma of the kidney. Coenen and Silberberg, in 1923, reported eight cases of perirenal hydronephrosis, seven of the cases being collected from the literature. In two of the eight cases the lesion was bilateral; and in one-half of the cases (4), the serous cyst was associated in the same kidney with a true hydronephrotic dilatation of the pelvis.

History of Case.—Patient is a female, aged fifty-three. (Case No. 27914–28905.) Family history negative. Chief complaint epigastric pain and vomiting. Sensation of uneasiness in epigastrium. Pain increased on pressure over right hypochondrium.

A poorly nourished female of about fifty-five years, who presents a palpable elastic mass over the right upper quadrant of the abdomen, which moves with respiration, and is exquisitely tender to the touch. It appears as an enlarged gall-bladder.

Cystoscopy, Doctor Hirst.—The bladder wall is covered with pus; right ureteral opening apparently normal; no obstruction to the catheter in passing up the right ureter. Urine from the right kidney clear. Patient was given 60 gr. of sodium iodide for X-ray of kidney. Mass noted in neighborhood of right kidney. Indigocarmin eliminated by each kidney in five minutes.

In view of negative cystoscopic findings, epigastric pain, vomiting, tenderness and mass over right abdomen which moved with respiration, patient was referred for operation with pre-operative diagnosis of cholecystitis.

Operation.—Under anæsthesia a large mass was palpable in the upper right abdomen, which mass was movable with respiration; impossible to decide whether kidney or gall-bladder was involved. An upper right rectus incision was made and the peritoneal cavity opened. Gall-bladder, stomach, and duodenum were found free from visible pathology. A large movable mass, the size of a fetal head, was palpated in the right retroperitoneal space. The peritoneum was then closed with continuous suture. The parietal peritoneum was separated from its attachment to anterior and lateral abdominal wall. The mass was slightly adherent; adhesions were easily separated. It was necessary to empty the cyst in order to remove it. When the cystic mass was emptied it was found to have its origin from the right kidney, involving about two-thirds of the organ. A nephrectomy was performed; the abdomen closed in layers. A small stab wound was made in the loin for drainage. Drainage removed in forty-eight hours. Convalescence without note, dis-

* Read before the Philadelphia Academy of Surgery, October 6, 1924.

charged sixteen days post-operative. Wound healed by primary union. Urine negative at all time following operation.

Specimen (Fig. 1) consists of a kidney, about two-thirds of which was replaced by a large perirenal cyst which contained approximately 1000 c.c. of clear serous fluid. The cyst presented no communication with the renal pelvis. The anterior, posterior and convex borders of the cortex of the kidney which formed the visceral wall of the cyst were covered by a 2 mm. thickened capsule which presented numerous trabeculæ. The thickened capsule over the kidney can be considered as the visceral layer of the perirenal cyst and the remainder of the cyst wall as the parietal layer. The outer surface of the kidney presented capsula adiposa. The cyst wall was trabeculated and showed evidence of previous hemorrhage. A number of small vessels were easily observed.

Histology. — Parenchyma of the kidney showed a mild interstitial nephritis, the interstitial connective tissue being somewhat increased. The kidney was covered by the visceral layer of the fibrous capsule. The fibrous tissue was poor in cells, and separated at places, some of the spaces were occupied by red blood-cells. The lining cells were flat cuboidal. Elastic fibres were demonstrated in the visceral and parietal layers. Uninterrupted passage of the visceral into parietal layers was demonstrated. The histology of the visceral and parietal layers was similar in appearance.

FIG. 1.—Represents specimen removed at operation of large perirenal cyst. For description see text.

Comments.—The clinical findings in cases of perirenal hydronephrosis are essentially similar to that of a large solitary cyst, so much so that even in the gross examination of specimens considerable difficulty may exist in differentiation. Viewed, therefore, from the standpoint of the clinical manifestations produced and the surgical therapy indicated, perirenal hydronephrosis and solitary cyst of the kidney are in every way alike. The problem of differentiation is one of etiology and careful histological study. It thus becomes necessary to include in this consideration some accompanying data concerning solitary cysts of the kidney.

The large cysts may involve either kidney, and any part of the kidney may be its site. The cyst wall is the kidney proper, and the inner wall of the cyst shows numerous trabeculæ. The latter are usually well vascularized.

The cysts vary in size; Leopold's case contained four litres of fluid. The large cysts may reach from the under surface of the liver or diaphragm to the pelvis. The infrequent occurrence of large solitary sérous collections in the kidney is evident from Schmeiden's study of 2100 kidney operations, collected from reports for the past thirty years; there were found but eleven cases of solitary cysts, one male and ten female. Schéde, in 184 kidney operations, found not a single instance. Israel, in 271 kidney operations, found the lesion once. The solitary cysts lie ental to the fibrous capsule. The kidney proper, aside from the cyst, presents an increase in connective cell infiltration. It is the large cysts which are of surgical importance; they usually occur in adults, and are far more common in females. It is of further interest that cysts of the Wolffian body likewise occur almost always in the female.

The exact diagnosis of a large renal or perirenal cyst is extremely difficult to establish. Clinically, it first becomes evident when it has attained considerable proportions. Lower, however, reports a small cyst in the upper pole of the kidney which was the source of marked symptoms with complete relief resulting upon removal. The rarity of their occurrence and the indefinite and vague symptoms which they produce are the probable reasons why the various types of cysts of the kidney reach the operating room undiagnosed. Mendelsohn says that of fifty-eight single serous cysts, only four were correctly diagnosed. It is noteworthy that approximately one-half of the cysts of the kidney were operated upon with a pre-operative diagnosis of ovarian cyst. The error is explained by the fact that the greater number of renal cysts have their origin in the inferior pole of the kidney and enlarge progressively caudal.

Bochenheimer reports the occurrence of a solitary cyst in the right half of a horseshoe kidney and Moynihan a case where both halves of a horseshoe kidney were the sites of solitary cysts.

Approximately ten per cent. of all renal cysts contain blood. In a number of cases hæmaturia was the first symptom to attract attention to this lesion. Similarly hæmaturia may appear as a symptom of uncomplicated serous cysts.

The symptomatology is variable, ranging from a sensation of fulness in the abdomen to the occurrence of intestinal obstruction as in a case of Silver's, where a left-sided renal cyst produced pressure upon the splenic flexure. In the writer's case, classical biliary colic attacks dominated the clinical picture. The symptoms are the result of pressure upon or compression of neighboring anatomic structures.

Palpation will disclose a smooth cystic tumor when the cyst has attained considerable size. Its unusual elasticity, and if right-sided in its occurrence and associated with a Reidel's lobe of the liver, may strongly suggest a hydrops of the gall-bladder, as in the case reported in this study. The diagnosis at times has been pancreatic cyst, omental cyst, etc.; and, as noted above, most commonly the solitary fluid collections in the kidney were operated upon with a diagnosis of ovarian cyst.

The retroperitoneal site of the kidney necessitates further differentiation from the various retroperitoneal tumors.

The clinical data suggesting the diagnosis of perirenal or renal cysts are the unilateral occurrence of a smooth tumor, the absence of any quantitative or qualitative changes in the urine and the negative cystoscopic findings. The ureteral and cystoscopic study is usually negative, as the fluid collection does not communicate with the pelvis. Doctor Nassau recently operated upon a child of seven years where the entire kidney was converted into a cystic sac, no urine appearing from the kidney of the affected side.

It is well to recall that an accompanying hydronephrosis of the kidney pelvis may be present. The diagnosis, therefore, must be made by exclusion.

The etiology of the large single serous collections in the kidney has been variously interpreted. At times the large solitary cyst which has reached considerable size closely resembles a perirenal cyst, and may present difficulty in differentiation. The large cysts are usually ental to the fibrous capsule. The cyst can be separated from the kidney parenchyma proper.

The visceral and parietal walls of perirenal cysts show a similar histologic structure, and blend indefinably into one another. The contained fluid is between the two layers of the fibrous capsule of the kidney, *i.e.*, intercapsular in position. This interpretation is strengthened when one recalls the normal anatomy of the kidney capsule. The latter is a very definite structure; unlike the capsule of other viscera, as the liver and spleen, the capsule of the kidney can be stripped from the kidney without loss of substance, a fact made use of in the so-called subcapsular nephrectomy. Furthermore, it has its own blood and lymph supply.

The kidney proper is entirely enveloped by its fibrous capsule—capsula fibrosa perinephrium. Ectal to the latter and enmeshed with it is a mass of fatty connective tissue. The connective tissue of this fatty capsule becomes condensed peripherally to form the perirenal fascia. The fascial envelopment of the kidney is incomplete at the inferior or lower pole, thus establishing a communication between the capsula adiposa and the retroperitoneal fat.

The blood supply of the tissues surrounding the kidney, including its fibrous capsule, is very rich; it receives branches not only from the renal arteries, but also from the first lumbar artery, inferior phrenic and suprarenals.

A study of the lymphatics of the kidney discloses that in addition to the lymphatics of the kidney proper, the fibrous capsule has a second series of lymphatic vessels, the space between the two layers of the capsule constituting a large lymph space. (Bärtels, Bröosike, Stöehr.) The capsula adiposa similarly has an individual lymphatic network. The three systems of lymphatics in relation to the kidney—first, kidney proper; second, fibrous capsule; third, capsula adiposa—anastomose with one another.

The belief has been expressed that a perirenal cyst may originate in a preceding infection or trauma limited to the fibrous capsule. As noted above, the latter possesses a rich individual blood and lymph supply, and may, there-

fore, be the site of pathology independent of the kidney. Four types of perinephritis are described:

1. Perinephritis serosa, in which type there occurs a serous exudate between the two layers of the fibrous capsule. This is the form that may terminate in a true perirenal cyst if extensive exudation occurs.

2. Perinephritis hemorrhagica is applied to the form that usually follows a perirenal hæmatoma or so-called massive hemorrhages of the renal bed. The hemorrhagic type may become encapsulated and result in a renal or perirenal cyst, in a manner similar to the apoplectic cyst of the brain, the reabsorption of the sanguinous fluid being followed by a serous exudate.

Recently Hildebrand reported three perirenal cysts close to, but not intrinsically, a part of the kidney. The cysts were outside of the kidney and its fibrous capsule. A study of the walls of the cysts showed connective tissue without endothelium, covered by a more or less completely organized blood clot. He attributed their formation to injury of the capsula adiposa resulting in hemorrhage, which later became incapsulated, thus forming a true perirenal cyst. This type of cyst is important to bear in mind. It can be completely removed, without disturbing the kidney proper.

3. Purulent perinephritis arises from the rupture of small cysts or abscesses of the kidney into the capsule, resulting in a perinephritis or a perinephric abscess.

4. Chronic perinephritis includes a group of cases which at autopsy exhibit adhesions between the capsule and cortex of the kidney. The kidney proper presents no visible pathology.

This group of cases probably represents the most common end result of perinephritis serosa, and may be the underlying source of obscure lumbar pains for which there appears to be no tangible cause.

The concomitant occurrence of perirenal cyst and true hydronephrosis of the kidney pelvis was found in one-half of the reported cases of perirenal hydronephrosis. No demonstrable cause for the obstruction, such as stricture, tumor or stone, was found which would explain the associated hydronephrotic pelvis. The latter fact adds a further possible causative factor—the rôle played by infection in the production of a hydronephrosis.

A form of hydronephrosis occurs which involves the pelvis and in which no definite etiologic factor is evident. Braasch has definitely shown that dilatation of the ureter or pelvis may occur without mechanical obstruction. Many puzzling questions exist concerning the mechanism of hydronephrosis. Hydronephrosis, the result of an abnormally coursing renal artery, may be included in this group. Even in the latter class, there appears to be a considerable number of dissenting opinions and the belief is expressed that one must look for causes other than the mechanical effect of the aberrant renal artery.

As noted in some cases, perinephritis may be the underlying cause of a perirenal cyst. The infection similarly may produce the accompanying pelvic hydronephrosis. Rumpel, in a series of 67 hydronephroses, found that

one-third of the cases belonged to a group for which no mechanical obstruction could be demonstrated. He attributed their formation to the action of toxins which interfered with the innervation and normal peristaltic action of the ureter and pelvis. Primbs, quoted by Rumpel in a series of animal experiments, definitely induced stasis of the ureter and pelvis by the action of bacterial toxins.

Other observers have attributed the formation to hereditary tendencies, etc. Its occurrence, however, is noted more commonly in those nervous visceroptotic individuals in whom innervation disturbances are most prone to occur.

The congenital origin of renal cysts is more or less familiar to every medical man, and there exists an abundant literature on this subject. Kampmeier's observations indicate that every human individual, during his fetal life, normally passes through a period which is characterized by the presence of numerous cystic renal tubules. Such a normal physiologic event may be converted into an abnormal pathologic condition if these cysts continue to grow and expand; and it is readily understood how large renal cysts so frequently found in post-mortem examinations of infants as well as adults may be produced.

Treatment.—Excision of the cyst is advisable if the latter is small. Puncture of the cyst has been recommended. Kirmisson in a case in which puncture of the cyst was done, had a urinary fistula resulting, which necessitated a subsequent nephrectomy. In a number of cases in which conservative renal surgery was carried out, a secondary nephrectomy became necessary because of resulting hemorrhage. In large cysts of long duration, which include more than one-third of the kidney substance, with a good normal kidney on the opposite side, nephrectomy appears to be the most logical surgical procedure.

Abdominal Extraperitoneal Nephrectomy.—The nephrectomy performed in the case described above was technically carried out by utilizing the extraperitoneal approach. Every surgeon of experience in renal surgery, through choice or necessity, has probably at some time made use of this method of nephrectomy. Surgery of the kidney, as in surgery of other viscera, must be individualized, suiting the operation to the indications and needs presented. This method of nephrectomy finds its greatest field of usefulness in the removal of tumors or large cysts of the kidney. Congenital lesions of the kidney, such as horseshoe kidney, with its variation in blood supply and other abnormalities, are anatomically more accessible through the abdominal approach. The advantages of the abdominal exposure in congenital lesions of the kidney was noted by the writer in 1918 in a study of fused kidneys. In cases that present uncertainty of diagnosis, even after careful study as to whether the kidney is the source of the symptomatology, it permits exploration of the abdominal cavity and exposure of the kidney through the same incision.

In traumatic injuries which involve the abdomen and kidney or kidney

bed, the abdomen and kidney areas can be explored through one incision. The peritoneum is closed before beginning exposure of the kidney. Furthermore, in kidney cases which require reoperation, it permits an approach to the kidney through an exposure free of adhesions.

Kronlein, Gregorie, Czerny, Albarran and others have commented on the value of the abdominal approach in the exposure of the kidney, particularly in large tumors of the kidney. A variety of incisions have been recommended for this procedure. In the Albarran and Gregorie technic, the incision is carried through the muscular portions of the abdominal muscles. Kronlein advises the addition of a transverse cut to the lateral border of the rectus muscle, extending from the end of the lumbar incision. The incision best adapted for the abdominal approach to the kidney is the usual upper lateral rectus incision which is carried down to but not through the peritoneum. If indications appear which warrant an abdominal exploration, the peritoneum is incised and the abdominal cavity explored; the incision in the peritoneum is sutured before beginning the detachment of the parietal peritoneum in order to expose the kidney.

It is surprising how easily and rapidly the parietal peritoneum can be separated from its mural attachments without rupture of the peritoneum if certain precautions are followed. The separation of the peritoneum is preferably begun at the lateral border of the rectus muscle. Commencing the separation in the median line is to be avoided, for at this point the peritoneum is markedly adherent, and the possibility of a peritoneal tear in the act of detaching the parietal peritoneum is greatly increased. The parietal peritoneum in its lateral attachments usually detaches and separates with great ease and with very little force. The separation is best effected by including some extraperitoneal areolar tissue with the parietal peritoneum. The laxness of the attachments of the parietal peritoneum increases in the lateral aspects.

Observation of hundreds of cadavers in the dissecting room of the Daniel Baugh Institute of Anatomy of the Jefferson Medical College, covering a period of ten years, forms the basis for the above facts. It is well to note that the outer surface of the parietal peritoneum rarely exhibits marked adhesions in its mural attachments. It has been repeatedly demonstrated that in cases of extensive intra-abdominal adhesions, which are attributed to tuberculosis or other causes, the entire parietal peritoneum can be separated from the abdominal wall in a manner similar to cases where no intra-abdominal pathology is grossly evident. In order to avoid tearing of the peritoneum during the process of separation, use is made of large wet packs, as in the radical operation for malignancy of the testicle, which are maintained by retractors, thus removing considerable tension from the peritoneum.

Anatomically, extraperitoneal nephrectomy offers a safe and easy approach to and exposure of the kidney. The pararectus incision injures no muscles and can be increased medially or laterally without difficulty if needed. Relaxation or hernia of the abdominal musculature, the result of

injury to its innervation, is less liable to occur with the abdominal incision than with the lumbar incision. The writer has seen two cases of complete relaxation of one-half of the abdominal wall as a sequence of the lumbar incision; both cases were operated upon by surgeons of great experience. The kidney is exposed lying in its natural bed undisturbed. The vessels of the kidney are directly under the eye; aberrant renal arteries present no element of danger as they are directly visible. The incision is immediately over the pedicle of the kidney. The kidney hilus, the posterior cava, etc., are under direct vision, and the ureter can be followed to the bladder. Injury to adjacent anatomic structures, such as duodenum, posterior cava, etc., is practically eliminated.

In technically difficult nephrectomies, the resulting trauma may force bacteria, nephrotoxins, thrombi or emboli into the circulation. The great danger of squeezing tumor cells directly into the wide renal veins is eliminated. The vessels can be ligated and cut under direct vision, the kidney lying undisturbed. Charles Mayo in five cases incised the renal vein and removed a contained tumor thrombus. Judd, etc., recently commented on the occurrence of thrombosis and embolism resulting from renal tumors.

The ease of operating with the patient on his back is a consideration of prime importance. In a series of sixty-two nephrectomies, Bünge noted the great frequency with which albumen and casts were found in the urine as a post-operative sequelæ to a nephrectomy which had been carried out through the lumbar route; examination of the urine of the uninvolved kidney obtained by ureteral catheterization before operation having shown no pathology. The appearance of albumen and casts following kidney operations is so common that its occurrence is seldom missed. Usually it is harmless and frequently it disappears in a few days. At times the albuminuria may persist and eventuate in uræmia. Many explanations have been advanced for this post-operative kidney lesion.

As a result of a careful study of this problem, Bünge attributed the injury of the sound kidney to be largely the result of the hard non-resisting pressure from the use of metal or sand bags which are usually utilized for securing and maintaining the proper position in the lumbar approach to the kidney. The non-resisting pressure produces considerable trauma and squeezing of the non-operated kidney during the performance of a lumbar nephrectomy. He thereupon substituted an elastic support in the form of an air cushion in place of the usual metal or sand bags, thus avoiding to a considerable extent any pressure injury to the sound kidney. The use of the air cushion greatly diminished the incidence of albuminuria which followed lumbar nephrectomy.

In two cases where the nephrectomies were performed through an abdominal incision, Bünge noted the absence of injury to the remaining kidney. Nephrectomy by means of the abdominal approach eliminates the element of pressure during the operation as a possible source of danger to the good kidney.

REFERENCES

Böchenheimer: Berlin Klinisch Woch., 1911, Nr. 36.
Bünge: Beïträge Zür. Klinisch Chir., vol. cxv, 1919, p. 125.
Coenen and Silberberg: Beïträge Zür. Klinisch Chir., v. 130: 2, 1923, p. 374.
Connerth: Ztschr. f. Uroloj. Chir., Bd. xl, p. 169, 1923.
Härms, C.: Beïträge Zür. Klinische Chir., vol. cxxv, p. 688.
Hildebrand: Arch. f. Klinisch Chir., August, 1924.
Kirmisson: Rev-de-Chir., vol. xix, 1899, p. 285.
Mendelsohn: Ztschr. f. Urolog. Chir. Bvd., p. 295.
Minkowski: Mitt Grenzeb., vol. clxii, p. 260, 1906.
Rümpel: Beïträge Zür. Klinisch Chir., vol. cxxvi, p. 1, 1922.
Schmeiden: D. Ztschrf. fur. Chir., Bd. lxii, p. 205.
Kampmeier: Surg. Gyn. and Obst., February, 1923.
Lipshutz and Hoffman: ANNALS OF SURGERY, July, 1918.

SITUS INVERSUS ABDOMINALIS COMPLICATED BY ILEO-CÆCAL TUBERCULOSIS PRODUCING ACUTE INTESTINAL OBSTRUCTION

By George Albert Moore, M.D.
of Brockton, Mass.

The earliest recognition of tuberculosis limited to the ileo-cæcal region probably dates back to a case operated upon by Czerny in 1886, in which this condition was found on pathological examination. Similar cases were reported by Von Hacker in 1888, by Suchier in 1889, by Gussenbauer in 1890 and by Billroth in 1891. A comprehensive study of ileo-cæcal tuberculosis was made by Hartmann and Pilliet in 1891 and credit for establishing the disease as a clinical entity is due them. In 1893, Benoit found 21 cases reported in the literature and in 1895, Courath collected 85 cases in studying this condition. Writing on the subject again in 1907, Hartmann reported 217 cases which had occurred in his practice. In a study of 500 cases of intestinal tuberculosis, Fenwick and Dodwell found 85 per cent. in which the cæcum was affected and in 9.6 per cent. the cæcum alone was involved. While intestinal tuberculosis is of fairly common occurrence, limitation of the process to the ileo-cæcal region is quite rare.

Few now question the statement made by Hartmann and by Billroth that many patients in the past in whom an inoperable carcinoma of the ileo-cæcal region had been diagnosed as well as others who had been operated upon and recovered, were suffering from a localized tubercular process. Weiner asserts that many cases operated upon for appendicitis with inflammatory exudate about the cæcum, in which the pathologist finds only a chronic inflammation, later develop intestinal tuberculosis.

There is still considerable divergence of opinion regarding the incidence of ileo-cæcal tuberculosis as a primary or secondary lesion. Leoper states that it is often secondary to pulmonary tuberculosis, but that about one-third of the cases are primary, Lartigan says that there is no proof that it is ever secondary to pulmonary tuberculosis. Courath asserts that in children the disease may be primary, but that in adults it is not. Hartmann believes that the lesion is primary in adults, but in the later stages the surrounding peritoneum may be involved as well as the lungs and that the patient may die from pulmonary tuberculosis. Campiche studied 279 cases and found pulmonary lesions in less than one-third.

Infection probably results from the ingestion of infected food or swallowing sputum which stagnates in the cæcum; or by bacilli carried by the blood stream to the terminal ileum or head of the cæcum. The blood supply of the terminal ileum, appendix and cæcum being furnished by the ileo-cæcal artery favors the theory of infection by bacterial emboli. Of the predisposing diseases to ileo-cæcal tuberculosis, typhoid, the enteritides and dysentery are the most common, though as yet their causal relationship lacks positive proof.

The disease occurs in two forms: 1. Ulcerative and caseous. 2. Hyperplastic. 1. The ulcerative and caseous form is an active inflammatory process. There is often a pericæcal inflammation or a mass surrounding a caseous abscess made up of terminal ileum and cæcum. In the late stages there may be fistulæ formed through the abdominal wall, but strictures of the intestine are not seen with this form. 2. The hyperplastic form of the disease is of greater interest to the surgeon than the ulcerating type. The process is often found localized so that it is amenable to some form of surgical treatment. Hartmann states that the disease is most frequently found limited to the cæcum, that it usually spreads toward the ascending colon and may even involve the sigmoid. The ileum is rarely involved and is a late manifestation of the disease according to this writer.

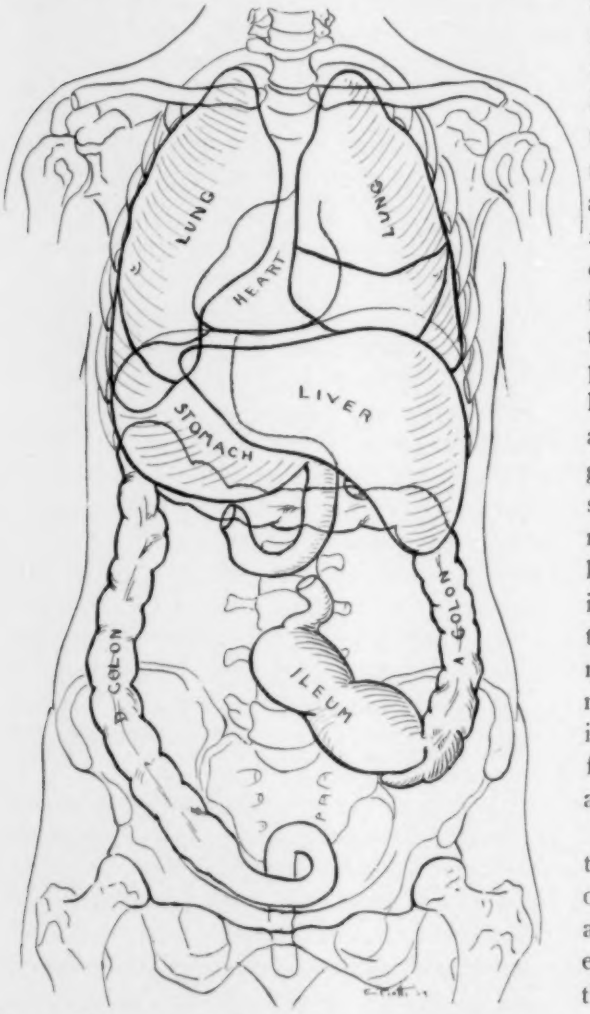

FIG. 1.—Diagram of organs as found at autopsy. Note complete situs inversus and marked dilatation only of terminal ileum.

Loeper asserts that the terminal ileum is the site of election of the disease and Lartigen says the disease is usually localized in the ileo-cæcal region.

Involvement of the ileum proximal to the last eighteen inches is quite uncommon, although cases have been reported of numerous strictures of the ileum. The appendix is rarely involved in the tubercular process, but is often found imbedded in adhesions.

The appearance of the intestine is that of a specimen long preserved in formalin. The walls are firm, grayish-white and enormously thickened, often three or four centimetres in thickness. The mass which is composed of terminal ileum and cæcum and much fibrous adipose tissue is rarely adherent to adjacent viscera, but is often firmly bound to the abdominal wall posteriorly.

Caseous glands are often found imbedded in the mass. Narrowing of the lumen is the common result of the process usually most marked in the cæcum and at the ileo-cæcal valve. Areas of stenosis are frequently found accounting for the usual long history of chronic obstruction and the terminal acute obstruction.

In a few cases stenosis is due to the formation of cicatrices from circular ulcers of the intestine; in others ulcers occur in conjunction with a hyperplastic process. In most cases, however, the pathology is not a destructive but a proliferative change. The serous and mucous coats are rarely involved, the deposition of fibrous adipose tissue may be found in the sub-mucous, muscular or subserous coats.

Ileo-cæcal tuberculosis, whether ulcerative or hyperplastic type, is a disease of long duration. Hartmann says that the average course of the disease is at least two and a half years; but on account of its insidious onset it is difficult to state just when the disease begins. Recurring mild attacks of indigestion and enteritis are common to both forms of the disease. Later in the course of the disease the ulcerative form is characterized more by symptoms of inflammation frequently simulating appendicitis, or there may be abscess formation with fistulæ.

Development of a tumor in the right iliac region with stricture is characteristic of the hyperplastic type. Alternating constipation and diarrhœa, with loss of weight, attacks of partial obstruction of gradually increasing severity are further evidence of the disease. In emaciated patients the tumor is palpable and frequently visible; visible peristalsis also is observed frequently in the late stages. Death may result from pulmonary tuberculosis, though this is a rare complication of the hyperplastic form. Frequently, as occurred in my case, the terminal stage of the disease is an acute obstruction, usually occurring later in the course of the disease than in carcinoma.

Other causes of death are cachexia and diffuse tuberculosis of the intestines and peritoneum.

The diagnostic signs that are of value are the persistence of the mass after subsidence of subacute inflammatory symptoms simulating appendicitis and the frequent pulmonary involvement in the ulcerating forms of the disease.

Symptoms of stenosis of long duration with a freely movable smooth tumor is diagnostic evidence in favor of tuberculosis rather than malignancy.

The treatment of the ulcerating form depends somewhat upon the urgency of the symptoms. In general better results are obtained by medical and hygienic than by surgical treatment.

For the hyperplastic form surgery should be advised, but as in the ulcerating form the patient's condition is the deciding factor in operative procedure.

Hartmann is in favor of excision in selected cases. He reported 229 operated cases collected from the literature with 46 deaths and the remainder cured. Seven of these were resections with one death. Brieger (cited by Weiner) reported 27 resections with a mortality of 15 per cent. Campiche

also (cited by Weiner) found the mortality to be 20 per cent. following resections.

Lateral anastomosis or ileo-colostomy, using healthy intestine well above and below the disease, has been advised by many writers. It carries a lower operative mortality than resections with nearly as high percentage of cures. The physical condition of many of these patients precludes a formidable operation as a resection. Acute intestinal obstruction as a terminal stage of

FIG. 2.—Showing the small contracted cæcum, acutely inflamed and thickened appendix and strictures of the terminal ileum and ileo-cæcal orifice with obliteration of ileo-cæcal valve.

ileo-cæcal tuberculosis is said by many authors to be of not uncommon occurrence. Its surgical treatment is similar to that of obstruction from other causes, whether excision, relief of the cause, anastomosis or simple enterostomy with pre-operative or post-operative supporting treatment depends upon the gravity of the symptoms.

Situs inversus or *transposition of viscera* occurs in two forms: 1. Partialis or transposition of one or more organs. 2. Totalis or transposition of all of the thoracic and abdominal organs. *Situs inversus partialis* is a developmental deformity and in many instances is the causative factor of serious disturbances resulting from anomalous position of organs or blood-vessels. *Situs inversus totalis* according to Schwalbe (quoted by Boeminghaus) is not a malformation but a normal possible variation of development, and a person with this condition differs in no way from ordinary individuals.

One of the earliest recorded cases of transposition of viscera was reported by Petrus Severinus of Rome in 1643. A few years later in 1652, Riolan,

Dean of the medical faculty of the University of Paris, reported two cases of complete transposition found at autopsy.

Complete transposition or *situs transversus* of the Germans is generally thought to occur about once in 4000 cases. Kerr found two cases in 10,000 autopsies. Bland-Sutton reported one case in 3000 abdominal operations. It is of personal interest that in a private practice, which according to carefully kept records now numbers over 20,000 cases, one case of known complete transposition has been seen and three others observed with the heart on the right. According to the experimental work of Mangold upon larvæ of the Triton, inversion of the heart was always accompanied by complete inversion of the abdominal organs. If this condition exists in inversion of organs in human beings, as we are led to believe, then all four of my cases can be fairly considered complete transpositions.

The occurrence of this anomaly is not rare, its diagnosis in the past has been made in most cases in the autopsy room or on the operating table. Recognition during physical and Röntgen examination is still so rare that they are the subject of reports. Many theories have been advanced regarding the causes of situs transversus and considerable amount of experimental work carried out with eggs in the early stages of development.

The position of the embryo in the amniotic membrane was formerly thought to be a factor in determining the site of viscera. This theory was advanced by Forster, who stated that if the embryo were on the right side of the umbilical vesicle, situs inversus occurred and further that in double formation one person shows frequently situs inversus.

Coller states that in single formation with situs inversus, there was originally a double formation in which the left-sided formation was destroyed.

Boeminghaus believes that in 50 per cent. of double formations or twins, one individual will show a situs inversus.

Many investigations have been undertaken to produce this condition by warming hen's eggs on one side, but results have not been conclusive. Spemann and Falkenberg, and in later years Spemann alone, have undertaken experiments with the eggs of Triton tænitus, first by ligation of the egg with a fine thread or hair during the early stage of development or gastrulation stage; by pricking the egg with a fine glass needle; and in a late stage of development by transferring or rotating a small part of the dorsal plate. Spemann asserts their experiments show that there is some factor normally located on the left side which controls situs and that if transferred to the right as in their experiments a transposition will result.

Experiments similar to those done by Spemann were carried out by Wilhelm and later by Mangold. Both obtained results that were in direct contradiction to those of Spemann.

Mangold found that in all cases where the heart was inverted, the abdominal viscera were also, but that the abdominal organs might be inverted and the heart in normal position. He concluded that the cause for situs inversus was some factor which controlled the position of the intestinal viscera.

Case Report.—Male, age thirty-nine years. Referred by Dr. Charles G. Miles. History unimportant until about five years ago, when he began to have attacks of constipation, with distress across the upper abdomen, immediately after meals, usually accompanied by vomiting. Medicine or care in the choice of food gave no relief from pain. The attacks occurred at first at intervals of two or three months, lasted one or two days and were relieved by copious movements of the bowels. Between the attacks he felt perfectly well except that he had a rather persistent diarrhœa, and certain foods as meat and some vegetables would cause a recurrence of the attack. During the past two years the attacks have occurred once a month and have gradually become more severe. About one year ago he had a very severe attack lasting three weeks. Has been losing weight for several months.

The present attack began about one week ago, similar to those in the past, but more severe. Since the onset he has been unable to eat anything but soup and milk toast, and has vomited much of that. For the past three days has vomited practically everything taken, has complained of a rather general abdominal pain and has become markedly distended. When admitted to hospital, July 20, 1922, he had had no bowel movement for four or five days. He was a fairly developed, poorly nourished man. Face pale and pinched. Tongue coated, teeth foul, throat normal. Lungs clear and resonant throughout, no râles. Heart apex impulse in fifth interspace in right nipple line, no murmurs. Abdomen markedly distended, walls very thin, coils of intestines discernible with visible peristalsis. Considerable tenderness across the lower abdomen with no area of localized increased tenderness. Rectal examination negative. Blood pressure 130–70. White count 22,000. Urine: high color, specific gravity 1030, albumin 0, sugar 0, sediment normal. Diagnosis: intestinal obstruction. Immediate operation advised and accepted.

Operation.—Ether, Doctor Miles, Assistant, Doctor Bridgwood, Operation, Doctor Moore. Injection of field of operation with ¼ of 1 per cent. novocain and adrenalin. Abdomen then opened through a right rectus incision below the level of the navel. Distended, deeply congested coils of small intestine presented in the wound, there was no free fluid. Attempts to explore the abdomen seemed to cause much pain and the patient was given a few breaths of ether. A purse-string suture of Pagenstecher linen was then placed in a loop of the intestine, a small opening made and a rubber tube inserted. No attempt was made to empty coils of intestine by inserting rubber tube to distended coils. Patient was in poor condition on leaving the table and was draining very little. A subpectoral saline hypodermoclysis was given at once.

July 21.—There has been very little drainage from the enterostomy and a second enterostomy was done higher on the right side. Large amounts of saline were given by hypodermoclysis. Patient was losing ground and a transfusion was done, giving 22 ounces of blood. There was a temporary improvement in his condition but very little drainage from either enterostomy opening.

July 22.—Saline infusions were continued with little benefit. No drainage from the enterostomies. Patient losing ground and a second transfusion was done. Enterostomy then done in left lower quadrant with escape of a large amount of watery fecal material. Patient gradually lost ground and died during the evening of July 22.

July 23, Autopsy.—All thoracic and abdominal viscera transposed. Right lung has two lobes, left lung three lobes. Heart apex on right. The entire small intestine was markedly distended showing two enterostomy openings in upper ileum and one on left about two feet from the ileo-cæcal valve. About six inches from the ileo-cæcal valve was found a marked thickening of the wall of the intestine causing a stenosis which would barely admit a lead pencil. Beginning about one inch proximal to the ileo-cæcal valve and extending to the head of the cæcum and appendix was another area in which the walls of the intestines were much thickened, as was also the appendix. The appendix was acutely inflamed. The lumen at the ileo-cæcal valve was completely closed. The macroscopic appearance was that of a chronic hyperplastic process which had greatly narrowed the lumen at the ileo-cæcal valve. The acute inflammatory condition of the appendix had

caused œdema of the surrounding tissues resulting in a complete occlusion at this point. (See Fig. 1.)

While this man was so thoroughly toxic that adequate drainage at first would probably have made little difference with his length of life, there is a possibility that had we followed the suggestion from finding a heart on the right side and made our incision and enterostomy on the left, our chances of getting away with the case would have been better. My other criticism of the treatment would be to question the value of transfusion in a patient so extremely toxic. It has helped in a few similar cases.

The following is the pathological report from the Harvard Medical School:

Specimen consists of a portion of the intestinal tract showing atresia. Sections through this area microscopically present a picture of tuberculosis, with extensive thickening of the muscular wall and infiltration by inflammatory cells. Several small tubercles with giant cell formation, epithelioid cell proliferation and mononuclear cellular infiltration are noted. The mucosa shows less extensive involvement, although in the lymphoid structures of the submucosa, similar tuberculous foci are seen.

Diagnosis.—Tuberculosis of the intestine.

REFERENCES

ILEO-CÆCAL TUBERCULOSIS

Allbut and Rolleston: Syst. of Med., vol. iii, 1907, p. 571.
Choyce: Syst. of Surgery, vol. ii, 2nd. Edition.
Davis and Boynter: S. G. O., vol. xxxiv, 1922, pp. 35–41.
Fenwick and Dodwell: Nelson Loose Leaf Med., vol. v, p. 302.
Graham: Jour. Lancet, vol. xxxvii, 1917, p. 605.
Hartmann: Brit. M. J., Apr. 13, 1907, p. 849.
Lartigan: J. Exp. Med., vol. Ix, 1901–05, p. 23.
Rolleston: Nothnagal's Ency. Prac. Med., vol. viii.
Weiner: Am. Surg., vol. lxix, 1914, p. 706

SITUS INVERSUS

Arnilla: Am. J. M. Sc., 1902.
Aubert: B. et M. Soc. Anat., vol. xci, 1921, pp. 154–57.
Bell and Winer: M. J. of Australia, Apr. 10, 1920, p. 339.
Boeminghaus D.: Zeit. f. Chir., vol. clv, 1920, pp. 174–88.
Brimblecombe: Brit. M. Jo., vol ii, 1920, p. 889.
Case: Am. J. Rönt., June, 1916.
Ebstein: Zeit. f. d. ges. Anat. z Abt., vol. viii, 1921, pp. 42–53.
Engelman: Wien. kl. lochn., vol. xxxii, 1919, p. 951.
Gould and Pyle: Anom. and Curios of Med., 1897.
Hedwig: Archiv. f. Entwick, vol. xlviii, 1921, p. 517.
Kelly: Brit. Jo. Surg., vol. viii, 1920–21, pp. 137–39.
Lane: Bost. M. and S. Jo., vol. clxxxi, 1919, pp. 641–43.
Lineback: J. A. M. A., vol. lxxv, 1920, pp. 1775–78.
Lochte: Beit. z Path. Anat., vol. xxiv, June, 1898, p. 187.
Mangold: Arch. f. Entrockl. d. Organ., vol. xlviii, 1921, pp. 505–16.
Menetrier: B. et m. Soc. anat., vol. xci, 1921, pp. 512–18.
Myers: Proc. Royal Soc. Med., vol. xiv, 1920–21. Sect. Div. Child., pp. 4–7.
Ochsenius: Monats. f. Kinderh., vol. xix, 1920–21, pp. 27–33.
Reed: N. Y. M. Jo., vol. cxiii, 1921, pp. 497–504.
Riolan: Soc. Anat. de Paris, vol. xci, 1921, p. 512.
Sherk: S. G. and O., vol. xxxv, 1922, pp. 53–57.
Toy: J. A. M. A., vol. lxxiv, 1920, p. 322.
Upson: Amer. Jo. Röntgen., vol. viii, 1921, pp. 385–88.
Wilhelmi: Arch. f. Entwickl. d. Organ., vol. xlviii, 1921, pp. 517–32.

THE RELATION OF THE APPENDIX TO THE RIGHT KIDNEY AND URETER*

By Henry A. R. Kreutzmann, M.D.
of San Francisco, Cal.

There is no doubt that the appendix is still the bete noire of medicine. This organ is of particular interest to the urologist since he is often called on in confusing conditions to rule out urological pathology.

Anatomical.—According to the older anatomists, eight different positions of the appendix were regarded as normal. They believed that this organ projected from the cæcum and lay free in the peritoneal cavity, with its tip pointing either cephalad, towards the left or downwards into the bony pelvis.

Gladstone and Wakeley [1] working on this problem since 1914 have recently tabulated their findings in 3000 cases. They have come to the conclusion that there are six normal positions of the appendix. The one most frequently found, they classify as post-cæcal and retrocolic. It occurred in 69.2 per cent. of the cases examined. Their work is of a most painstaking and thorough character. No other investigators have examined and tabulated anywhere near that number of cases. Therefore it is of great interest to note that the appendix in nearly three-fourths of their examinations was behind the cæcum or the ascending colon.

There are many abnormalities of the appendix. Occasionally one finds a failure of descent of the cæcum. Here the appendix is high up in the abdomen and may lie directly in front of the right kidney or its pelvis.

Monks and Blake [2] found after examining 656 cadavers that in a certain number of instances the appendix, directed up behind the cæcum, passed over the anterior surface of the right kidney to within one centimetre of its upper margin. In other cases it lay between the right lobe of the liver and the right kidney. A third variation was to find the appendix behind the peritoneum, under the cæcum and extending to the lower border of the right kidney. A rare condition that sometimes occurs is to find the tip of the appendix adherent to the bladder.

It is very evident from the many studies made, that the appendix is closely related to the urinary organs on the right side and that indications characteristic of either group may occur, resulting in a most misleading chain of symptoms.

Following are the urological reports of two cases which emphasize distinctly the difficulties that sometimes occur in reaching a diagnosis:

Case I.—H. M., male, aged forty-nine years. Always well except for a severe attack of abdominal pain twenty years ago, diagnosed as gall-stones.

Four or five weeks ago, he began suffering occasional pain in his back which radiated into his right groin. Two days before admission to the hospital he was awakened during

* Read before the Urological Section at the 53rd Annual Session of the California State Medical Association.

the night with violent pain in the head of his penis, right testicle, groin, back and abdomen. Felt better in the morning. Two days later, he consulted a physician who gave him some capsules, as a result of which he had two bowel movements. The patient then consulted another physician who immediately sent him to the hospital. Physical examination at this time showed a large, plethoric man, writhing in pain which he referred chiefly to the head of the penis and right testicle. The abdomen was distended and tender to pressure particularly in the median line over the bladder and the right groin.

The right testicle was retracted to a moderate degree. Temperature 101. White count 15,450. Urinalysis showed a light trace of albumen, many pus cells and several blood cells. There were many hyaline casts. The patient at this time had had an almost complete anuria for twenty-four hours. X-rays of the urinary tract were negative for stones.

Cystoscopy was performed the day of admission. There were some abrasions on the wax-tipped catheter suggestive of stone. Yet I did not advise operation, as there was no evidence as to the position of the stone in the ureter. We were firmly convinced that a stone was present and hoped that the instrumentation would dislodge it. The fact that after cystoscopy, the patient began to secrete urine, his white count dropped and his temperature the next morning was 99 encouraged us a great deal. However, he died shortly afterwards.

A post-mortem examination showed sero-purulent fluid in the peritoneal cavity. The appendix was gangrenous, projected into the bony pelvis and lay directly over the right ureter. The latter was acutely inflamed and the lumen contained blood and fibrin.

Case II.—J. B., male, age twenty-one. Past history negative. Complaint: frequency, urgency and burning along the urethra. The patient's symptoms began three months before consulting a physician. At the time he was referred for urological examination he was voiding twenty to thirty times during the day. The urgency was so great, that at times he soiled his clothes. The burning was throughout the urethra and was not aggravated by urination. He also voided once at night time. He had absolutely no gastro-intestinal symptoms such as distress after meals, belching of gas, nausea or abdominal pain. Physical examination elicited exquisite tenderness of the right kidney on bimanual palpation and along the course of the right ureter, most marked over McBurney's point.

Temperature was 99.2. White count 8,800. Urinalysis showed forty to forty-five red blood-cells to the high dry field and an occasional leucocyte. No casts. X-ray of urinary tract negative. Cystoscopy negative throughout. No evidence of trigonitis or posterior urethritis. Urine cultures of bladder and both kidneys were sterile.

In view of the negative findings, the patient was referred to his attending physician, who on operating several days later, found a retrocæcal appendix. The ureter was greatly adherent at one point, and great care had to be taken not to cut it. The tenderness of the kidney and ureter gradually left, so that all pain had disappeared on the eighth day post-operative.

The patient was seen seven months later. All his urinary symptoms had disappeared shortly after the operation and he had gained seventeen pounds in weight.

Realizing the possible relation of the appendix to the urinary organs on the right side, one of the following conditions may be present: Appendicitis, acute or chronic; ureteral calculus; perinephritic abscess simulating appendicitis and vice versa; pyelitis and ureteritis; appendix adherent to the ureter; perforation of appendix into ureter or kidney pelvis; fecalith in appendix lying over ureter and simulating calculus. Fortunately, the majority of these conditions occur but rarely. If they do present themselves, we usually can

with modern methods of urological examination make the correct diagnosis and take the proper steps to relieve the patient.

Not infrequently there are shadows in the region of the ureter which on examination give evidence of being calculi either lying in a pouch or covered with mucus. In these cases one usually finds on operation that the concretion is outside of the ureter and may even be a calcified nodule in the appendix. In such instances it is impossible to make an absolute diagnosis.

We must be particularly on guard to differentiate between appendicitis and urethral calculus, as these two conditions are the ones which most commonly give conflicting symptoms.

The genito-urinary symptoms which may occur in appendicitis are: Frequency, dysuria, difficulty of urination, acute retention, tenderness in the right costo-vertebral angle, retraction of the testicle, pain in the right testicle. Cope [3] has stated that pain in the testicle occurs in five per cent. of cases of appendicitis in the male. It is not so severe as the general abdominal pain and the patient may not complain of it, unless questioned directly on the point. These urinary symptoms are the result of an irritated appendix or appendix abscess lying in the closest proximity to the renal pelvis, ureter or bladder.

Erdman,[4] in 1908, stated that the onset of calculus colic is not usually accompanied by generalized abdominal, epigastric or umbilical pain, that is so often seen in appendicitis. It is a point worth remembering and in case of doubt the patient should be carefully questioned as regards the beginning of his symptoms.

The greatest coöperation should exist between the urologist and the surgeon. If there is any question at all whether the condition is due to appendicitis or calculus, a urological examination should by all means be made. If the examination is negative, the instrumentation has done the patient no harm, and the time lost by waiting for the confirmatory evidence is negligible.

In questionable cases, too much stress should not be laid on the urinalysis. Anschutz [5] states that in appendicitis it is not uncommon to find hæmaturia, and if more careful urinalyses were made, red blood-cells would be found more frequently than they have been in the past. The literature, even up to the present, is full of reports of cases in which hæmaturia has been found in appendicitis. This seems to bear out Anschutz' statement.

The cause of the red blood-cells in the urine is still a mooted question. Some authors believe it to be renal and others state that it is of ureteral origin. Nove-Josserand,[6] after studying 28 cases of hæmaturia which he collected in 1914 and including three of his own, came to the conclusion that the blood in the urine was due to an acute congestion of the kidney.

Dieulafoy believed the cause to be a toxic irritation of the kidney and called the phenomenon appendicular toxic nephritis.

Anschutz, from pathological studies made of kidneys of patients who had died of appendicitis, believes that the hæmaturia is due to a circumscribed nephritis which may later become generalized. It is our opinion that it is due to both renal and ureteral irritation. In acute appendicitis a generalized

toxæmia occurs and the kidneys are involved, whereas in the chronic cases a localized reaction takes place at the point where the appendix is adherent to the ureter.

From a study of the literature and one's own experience, the conclusion is reached that there is a distinct relationship between the appendix and the right kidney and ureter. It is only by the keenest observation and the fullest use of our urological methods that we are able at times to arrive at a correct diagnosis. Urologists should always be on guard and bear in mind the possibility of appendicitis even in the face of the most typical genito-urinary symptoms. The surgeon in turn should realize that a urological examination will do the patient no harm and may be the means of finding the cause of the illness, thus sparing the patient a needless operation.

REFERENCES

[1] The British Journal of Surgery, Jan., 1924, vol. xi, No. 43, pp. 503–520.
[2] Boston Med. and Surg. Journal, Nov. 20, 1902, vol. cxcvii, No. 22, pp. 581–583.
[3] V. Zackary Cope: Proceedings of Royal Soc. of Med., vol. xv, pt., 3, 1922, Section on Urology.
[4] Erdman: New York Medical Record, 1908.
[5] Anschutz: Muenchner med. Wochenschrift, vol. lxix, Oct. 20, 1922, pp. 1473–4.
[6] Nove-Josserand: Journal d'Urology, vol. v, 1914, pp. 121-153.

INTRA-APPENDICAL POLYP

By Henry J. Vanden Berg, M.D.
of Grand Rapids, Mich.
and
William McK. German, M.D.
pathologist, blodgett memorial hospital

Papillomatous growths of the stomach and intestines are not so uncommon, whereas of the appendix only a few cases are on record. Structurally they are usually adenomata, but in rarer instances may be myomata, myoadenomata, lipomata, or even hæmangiomata and lymphangiomata.

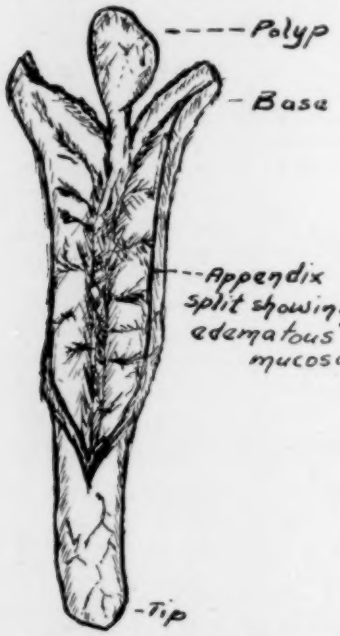

Fig. 1.—Appendix—drawing showing location and relations of polyp.

Simple polypi of the appendix are extremely rare. The writer was able to find mention in the literature of only three cases. A simple polyp is one in which the structure is mucosa and submucosa only—that is, without increase in such structures as usually exist in the papillomatous growths of the gastrointestinal tract (adenomata, etc.), as mentioned above. In the last edition of Kaufman's Pathological Anatomy there is no reference to polypus of the appendix. The first case was described by Vogel [1] in 1911. A year later M. Flamm [2] reported a case and a third case was added in 1913 by Sitkowski.[3]

The author's case was a young woman of twenty-one with a typical history and clinical findings of acute appendicitis. There had been previous milder attacks. At operation the appendix was found to be injected, œdematous, distended, and was surrounded by a small amount of exudate. The inflammatory involvement had extended onto the cæcal wall for a distance of half an inch in all directions. The circumference was quite sharply demarked. The indurated portion of the cæcal wall was removed with the appendix. Upon opening the latter a pedicled polyp the size of a hazel-nut meat was disclosed at the extreme upper end of the lumen plugging it almost completely.

Pathological Report.—An appendix 6 cm. long, œdematous and peritoneal vessels deeply engorged. It was opened longitudinally. It was found to contain, throughout its entire length, purulent fecal material. At its opening to the cæcum, attached to the mucosa, was a pedunculated polyp. (See sketch.) This polyp which was about 10 mm. in diameter seemed to act as a valve, swinging on its pedicle either into the lumen of the cæcum or that of the appendix.

Microscopic Examination.—Sections of the appendix show marked lymphoid hyperplasia, marked œdema and congestion and a dense infiltration of all structures with polymorphonuclear cells. The peritoneum shows marked œdema, but as yet the involve-

ment is slight. Sections of the polyp showed it to be a simple structure covered by a single layer of large intestine mucosa and supported by stroma carrying blood supply and lymphatics and here and there a lymphoid germ centre. The entire polyp structure was likewise œdematous and densely infiltrated with inflammatory cells.

The question naturally arises what is the etiology and pathogenesis of the polyp and what part did it play in the inflammatory process. Sitkowski thinks the polyp described by him resulted from irritation caused by a fecolith that was present. In Sprengel's work, p. 124, such a sequence, quoting Riedel, is mentioned. If Sitkowski's contention is correct the polyp reported by him may have been an "inflammatory growth" rather than a true polyp. A fecolith was not present in the cases cited by Vogel and Flamm, nor in the specimen of the writer. It is quite likely that simple polypi are of congenital origin, similar to the condition of polyposis intestini adenomatosa.

FIG. 2.—Photomicrograph section through tip of polyp showing a single layer of large intestine mucose and intensive infiltration with inflammatory cells. Diagnosis—acute appendicitis, obstructing polyp.

Now as to the relationship between the polyp and the inflammatory process! The immediate cause of appendicitis is, of course, bacterial, but normally every appendix contains organisms that ordinarily are found in the intestinal tract, yet infection is not likely to occur as long as there is no interference with drainage. Probably, then, inadequate drainage is the most important factor in appendicitis. The position, shape, size, narrowed orifice with the disadvantageous location of the orifice; *viz.*, at the upper extremity, all tend to hinder free drainage under the best conditions. Add to this, distortion, kinks, twists, fecoliths, new growths and so on, infection is rendered still more liable. It has been thought, for instance, that peculiar anatomy of the appendix is the explanation of the frequency of appendicitis in some families. The virulence of the bacterial organisms is undoubtedly augmented by drainage interference, a toxin of high potentiality is produced and the mucous membrane in turn becomes reduced in vitality. In consequence invasion of the wall is a matter easily accomplished.

Although there is nothing unusual in the relationship of the principal of defective drainage to appendicitis, yet the cause in this case, *viz.*, a simple polyp, is most unusual.

REFERENCES

[1] Vogel, K.: Ein Fall von chronischer Appendizits, verursacht durch einen Schleimhautpolypen in Wurmfortsatz (A Case of Chronic Appendicitis Caused by a Mucous Membrane Polyp in the Appendix). München, med. Wohnschr., 1911, vol. lviii, p. 2168.

[2] Flamm, M.: Ein Schleimhautpolyp in Wurmfortsatz (A Mucous Membrane Polyp in the Appendix). München, med. Wohnschr., 1912, vol. lix, p. 424.

[3] Sitkowski, P. P.: Polypus of the Appendix. Med. Obozr., Mosk., 1913, vol. lxxx, pp. 74–76, 1 pl.

HERNIA FOLLOWING THE USE OF THE McBURNEY INCISION IN OPERATIONS FOR APPENDICITIS

By Frank E. Fowler, M.D.
of New York, N. Y.

From the Second Surgical Division of the New York Hospital, Service of Dr. Eugene H. Pool.

Among the unfortunate sequelæ of abdominal operations where drainage is required are the occasional incisional herniæ. These are particularly of importance in acute appendicitis cases where prolonged and extensive drainage is necessary and it is here that this complication becomes a factor of great importance.

It is with the hope that these incisional herniæ may be prevented or at least diminished in number that this analysis of the cases of acute appendicitis, operated upon between January, 1920, and January, 1924, on Dr. Eugene H. Pool's Service at the New York Hospital, is reported Dr. F. W. Bancroft [1] has previously reported 584 consecutive cases operated upon prior to 1920 with an incidence of 15 per cent. herniæ in drained cases.

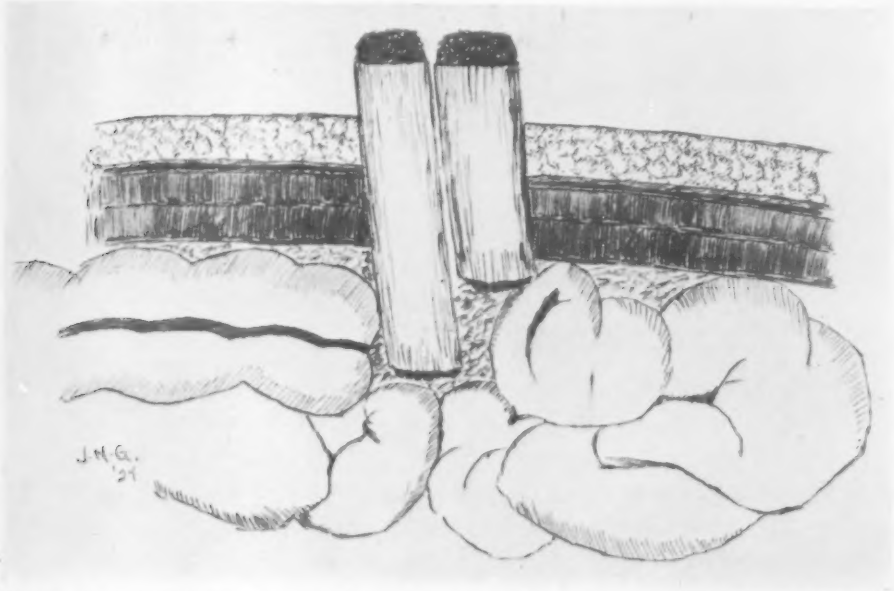

Fig. 1.—Diagrammatic sketch showing the two drains *in situ*, the deep one to the appendix base, the short one just within the peritoneum.

The cases in this report, 182 in all, are all drained cases and are of two types: those in which the wound was sutured above and below the drains, and those in which no sutures at all were used. It is the latter type which is of most interest to us, for it has been the routine procedure for the past two years to employ no sutures in these cases. All of the 182 cases reported

here have been followed for at least nine months and have been examined at regular intervals of three months or so since operation, either by the operator himself or a member of the staff.

The McBurney intramuscular incision was used in all the cases. This incision is used routinely in definite cases of acute appendicitis, as we believe it to be the incision of choice. It can be made more quickly than any other incision and produces less shock to the patient. It offers the best and most direct line of drainage. The patient's convalescence is shorter; the average

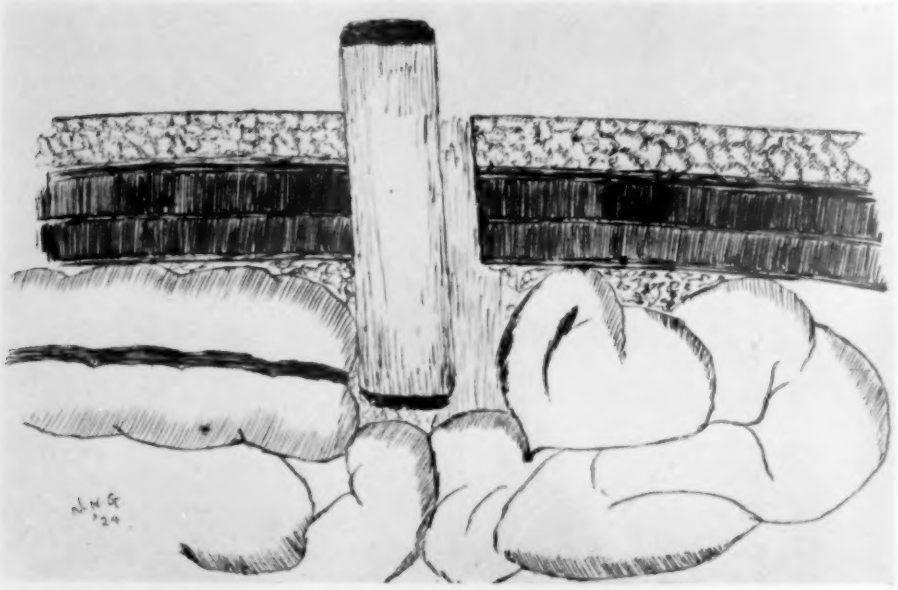

FIG. 2.—Diagrammatic sketch showing appearance of wound when short drain has been removed. A drainage tract is formed through abdominal wall around the deep drain.

time in the hospital of these cases being fourteen days, and the incidence of post-operative herniæ is much lower than with other incisions. Dr. C. E. Farr,[2] in an analysis of 34 cases, in which the right rectus incision was used, reported an incidence of 20.5 per cent. herniæ. Dr. F. W. Bancroft reported 37 cases in his series, in which the right rectus incision was used, with 21.6 per cent. herniæ.

The aponeurosis is one of the most poorly nourished tissues of the body, with a most insufficient blood supply to enable it to cope with any infection. Consequently its powers of resistance are very low. Due to this fact, it has been felt that any sutures placed through this tissue further contributed to its low vitality by constriction and pressure whereby its blood supply is further limited and necrosis encouraged. Therefore, it has been the custom in these cases to use no suture material whatsoever, making the incision quite small and diminishing its extent as one proceeds downwards to the peritoneum.

Drainage is established with two cigarette drains, one of which is removed in twelve to twenty-four hours, the other in thirty-six to seventy-two hours.

These drains are inserted in the following manner after a method developed by Dr. Eugene H. Pool: One deep to the appendix base or into the pelvis depending on the suppurative process, and the other just within the peritoneum. (Fig. 1.) This latter is the first one removed, the idea being to thus establish a drainage tract, not expecting to drain longer than forty-eight hours through the cigarettes. (Fig. 2.) Later the deep drain is removed and a small rubber tube inserted for a few days. Excellent drainage is established by this method and is maintained from the suppurative site the desired time. In two cases observed at autopsy by this writer on the fifth post-operative day, the rational of this procedure was amply demonstrated for the tube drains *in situ* were directly to the site of infection.

There are 182 cases in this series with an hernia incidence of 14 per cent. This is about the same incidence as in the series prior to 1920. However, when the cases are separated into the two groups the value of the non-suture method is shown. In 87 cases in which the layers were sutured above and below the drains, there were 14 herniæ, or 16 per cent. Thirty other cases of each type have been followed for only three to five months, during which time no herniæ have been noted. However, these are not included in this series, but will be kept under observation until two years have elapsd since operation.

Doctor Bancroft found in his cases the incidence of hernia was most common in infants and after forty years. However, in these cases here reported, the incidence is highest between twenty and fifty years, with a 75 per cent. occurrence after sixty. The incidence in males is slightly higher than in females, being approximately 20 per cent. and 15 per cent.

CONCLUSIONS

(1) The hernia becomes evident within the first year after operation, the majority within the first nine months.

(2) While this series is too small for one to draw any absolute conclusions as to the use of the non-suture method, the difference in hernial incidence 16 per cent. to 12 per cent. points toward an improvement and certainly seems to point a way to a method of reducing post-operative hernia following operations for acute appendicitis.

(3) This is presented as a preliminary report and as the series increase the analysis will be continued to further substantiate the method suggested here.

REFERENCES

[1] F. W. Bancroft: Acute Appendicitis. J. A. M. A., vol. cxxx, p. 1635, Dec., 1920.

[2] C. E. Farr: The Gibson-Mikulicz Tampon in Acute Appendicitis. ANNALS OF SURGERY, vol. lxxiii, p. 473, April, 1921.

REMOVAL OF SCREWS AND PLATES AFTER INSERTION IN BONE*

By Astley P. C. Ashhurst, M.D.
of Philadelphia, Pa.

It is easier to give impressions or opinions than to state facts. I have collected the following facts from my records of operations in which bones were fixed with metal. The number of bones I have fixed with metal to date (November 1, 1924) is 101: plates, 33 bones; joint screws, 54 bones; bands, 8 bones; wire sutures, 6 bones. This metal fixation has been removed subsequently from nineteen bones in 16 patients (19 per cent. of cases); it has remained in the other (82) bones for periods varying up to fifteen years, or until the patient's death from intercurrent disease.

Table I

Fixation	Bones	Removed	Indication	
Plates	33	9	Pain	4
Joint Screws	54	10	Infection	6
Bands	8	—	Incidental	8
Wire Sutures	6	—	Loose Screw	1
	101	19	16 patients:	19 bones

The indications for removal were:

(a) In *four* cases *pain;* but in none of these patients was the pain materially relieved by removal of the metal fixation, showing that this was not the cause of the pain, but that the latter was due rather to the persistence of a slight degree of deformity (all were operations for malunion at joints) which could not be entirely overcome at the time of the original operation.

(b) In *six* cases *infection;* this was present in *one* case (compound fracture) at the time of the original operation; it was aroused in *two* (old gunshot wounds of the German War) by my operation; it caused reopening of the wound in *one* case four months after operation; it occurred in *one* case two years after my operation as a metastatic infection from a severe tonsillitis; and developed soon after my operation in *one* case of simple fracture in civil life (T-fracture of humerus into elbow-joint) in which the mistake had been made of not waiting long enough before operation for the soft parts to recuperate; in this case the infection spread from the skin inwards.

(c) In *eight* cases the removal of the metal fixation was merely *incidental to another operation,* the screws or plates having given no indication of their presence, and being removed only because the parts were again exposed for some additional operation.

* Read before the Philadelphia Academy of Surgery, November 3, 1924.

(d) Only in *one* case did the fixation material give trouble by its mere presence: here it (a joint screw) was palpably loose beneath the skin; and was removed three months after operation.

TABLE II.

Removal of Metal Fixation from Bones

Original operation	Indication for removal	Intervals since insertion	Union	No. of screws Loose	No. of screws Tight
(1) Gray.—Recent fracture of tibia; plate	Incidental to op. for lac. wd. by horse-kick	14 mos.	yes	?	?
(2) Victor.—Recent fracture of tibia, compound; plate	Infection	10 days	no	2*	3
(3) Metcalfe.—Recent fracture ext. condyle of humerus; joint screw	Screw loose under skin	3 mos.	yes	1	0
(4) Parillo.—Recent fracture condyles of humerus; joint screws	Infection	3 weeks	no	3	0
(5) Rostau.—Malunion, elbow fracture; joint screws	Incidental	14 mos.	yes	1	1
(6) Patterson.—Malunion, ankle; joint screws	Pain	10 mos.	yes	3	0
(7) Cline.—Malunion ankle; joint screws	Pain	2 yrs.	yes	3	0
(8) Miller.—Malunion ankle; joint screws	Pain	6 mos.	yes	1†	2
(9) Fetrow.—Malunion wrist; plate	Pain	5 mos.	yes	4	0
(10) Donovan.—Malunion radius; plate	Metastatic infection on radius only	2 yrs.	yes	4‡	2
(11) Donovan.—Malunion, ulna; plate	Incidental	2 yrs.	yes	0	6
(12) Nial.—Malunion g. s. fract. of femur, 13 mos. old; plate	Infection	2 mos.	yes	?	?
(13) Snyder.—Malunion g. s. fract. of radius, 6 mos. old; plate	Infection	3 mos.	yes	3	2
(14) Fillmore.—Nonunion ext. condyle of humerus; joint screws	Incidental	6½ mos.	yes	0	2

* Loose screws were in distal fragment, and pulled out during removal of gypsum dressing.
† This screw covered by bone which had to be excised to expose head of screw which was loose inside.
‡ Two screws each side of fracture in radius.

TABLE II.—*Continued*

Removal of Metal Fixation from Bones

Original operation	Indication for removal	Intervals since insertion	Union	No. of screws Loose	Tight
(15) Hartzell. — Non-union ext. cond. humerus; joint screws	Incision re-opened	4 mos.	yes	?	?
(16) Hohlfeld.— Non-union radius; plate	Incidental	1 yr.	no	6	0
(17) Hohlfeld.— Non-union ulna; plate	Incidental	1 yr.	no	2	0
(18) Sholly.— Path. dislocation of L. hip, arthroplasty; joint screws	Incidental	5 yrs.	yes	0	2
(19) Sholly.— Ankylosis of R. hip, arthroplasty; joint screws	Incidental	5 yrs.	yes	0	2
				33	22

In four cases the metal fixation was removed by another surgeon; but in one of these cases, and in all sixteen cases in which it has been removed by myself, accurate notes were made as to how many of the individual screws, when removed, were found loose in their holes, and how many required the use of a screw-driver to unscrew them right up to their points before they could be removed. These facts are shown in Tables II and III.

TABLE III

Fifty-five Individual Screws Removed

	12 uninfected cases			5 infected cases		
Joint screws	Loose	Tight	Total	Loose	Tight	Total
Union	9	9	18	0	0	0
Non-union	0	0	0	3	0	3
Total	9	9(50%)	18	3	0	3
Plate screws						
Union	4	6(60%)	10	7	4(36%)	11
Non-union	8	0	8	2	3(60%)	5
Total	12	6(33%)	18	9	7(44%)	16
Grand Total	21	15(42%)	36	12	7(37%)	19

TABLE IV

Summary

	Loose	Tight	Tota
Total Joint Screws Removed	12	9(43%)	21
Total Plate Screws Removed	21	13(38%)	34
	33	22(40%)	55

If there are counted only those cases, seven in number (six cases of infection, and one case with the screw loose under the skin), in which removal of the metal fixation seems really to have been necessary (7 per cent. of the operations), it does not seem that metal fixation *when properly employed* is to be condemned, nor that, as many surgeons, state "a majority of plates have to be removed," nor that "all" screws soon become loose. If the two cases (Nos. 2 and 4) are omitted, in which buried metal fixation was, I believe injudiciously employed, the cases in which removal became necessary amount only to five per cent. of the total.

STATISTICAL RESULTS OF THE RADIOGRAPHIC STUDY OF INJURIES ABOUT THE WRIST-JOINT

By Ralph M. Carter, M.D.

of Green Bay, Wisconsin

This brief study is based upon an analysis of the skiagrams of 250 injuries in the region of the wrist-joint, taken from the files of St. Vincent's Hospital, a general hospital of approximately 200 beds. No attempt was made to pick them in any way. All skiagrams of the wrist for a given period were gone over, and the ones showing no bony injuries were discarded; the ones utilized for study, therefore, represent a consecutive series.

As has been noted by other writers, fractures and injuries in the neighborhood of the wrist in childhood and youth differ in several particulars from those of adult life, depending upon whether or not the epiphyses have united; this ordinarily has taken place by the twentieth year. In any study of a group of cases of these conditions, this fact is immediately brought to the attention, and the present series is no exception. Consequently, following the usual custom, I shall consider my findings under two headings: first, cases under age twenty, in which epiphyseal union has not yet occurred; and second, cases over age twenty, after union has taken place.

Cases in Which Epiphyseal Union is Not Complete.—There are 82 cases in this group, and I will consider the injuries to each bone separately.

Out of these 82 cases, the radius shows injury to some part in 72, or 87 per cent. This includes all forms of injury, both fracture and epiphyseal separation. The damage consisted in fracture of some part of the shaft in 70 per cent., and of these fractures, 40 per cent. were at, or very close, to the epiphysis; the others were in the diaphysis, generally about one inch from the lower end. All were within two inches of the lower articular surface. The shaft of the radius was injured alone in 10 per cent. of all cases, both radius and ulna in 40 per cent., and the radius with the styloid of the ulna in 12 per cent. No case of simple fracture of the radius with the styloid of the ulna was found, since other fractures were always associated, thus differing markedly from the conditions found after union of the epiphysis has taken place.

The line of fracture was transverse in 87 per cent. Backward displacement of the lower fragment was present in 75 per cent. of the cases, and forward in 10 per cent. There was no displacement in 15 per cent.

The epiphysis showed some injury in 27 per cent. of the injuries to the radius; it alone showed injury in 14 per cent. The injury to the epiphysis consisted in separation in 81 per cent.; of these separations, 80 per cent. showed dorsal displacement, the remainder none.

Turning now to the ulna, we find injury present to some part of the bone in 59 per cent. of the 82 cases. These injuries consisted in fractures of the shaft in 60 per cent. of all ulnar injuries, damage to the epiphysis in 12

per cent., and to the styloid in 28 per cent. In no case was the styloid injured alone. The damage to the epiphysis is consisted in separation; in two cases, the epiphysis was also fractured, in addition to being separated and dislocated. In 80 per cent. of the fractures of the ulna, the line of fracture was transverse. Of all these fractures, 80 per cent. were 2 inches or less (usually the latter) from the lower articular surface. There was dorsal displacement in 60 per cent., forward displacement in 15 per cent., and no displacement in 25 per cent.

No injuries to the carpal or metacarpal bones were found in this group, probably owing to the large amount of cartilage in their structure, in the younger cases especially.

The figures given above are summarized in Table I.

TABLE I

Cases in Which Epiphyseal Union is not Complete

A. Radius:	
Injury present in	87 per cent.
Damage to shaft in	70 per cent.
Damage to shaft alone in	10 per cent.
Damage to epiphysis in	27 per cent.
Damage to epiphysis alone in	14 per cent.
Epiphyseal separations, proportion	81 per cent.
Radius and ulna injury in	40 per cent.
Radius and ulnar styloid injured in	12 per cent.
Radius, transverse fractures	87 per cent.
Fractures at radial epiphysis	40 per cent.
Displacement of shaft fractures,	
Backward	75 per cent.
Forward	10 per cent.
None	15 per cent.
Displacement of epiphyseal separations,	
Backward	80 per cent.
None	20 per cent.
B. Ulna:	
Injury present (whole series) in	59 per cent.
Site of injury,	
Styloid	28 per cent.
Epiphysis	12 per cent.
Diaphysis	60 per cent.
Displacement,	
Backward	60 per cent.
Forward	15 per cent.
None	25 per cent.
C. Carpal bones and metacarpals	no injury.

Cases in Which Epiphyseal Union is Complete.—There were 168 cases in this group. The radius showed some injury in 164, or 92 per cent.; these injuries were confined to the radius alone in 45 per cent. The radius was fractured together with the styloid of the ulna in 43 per cent.; with the shaft and styloid of the ulna in 3 per cent. The fractures of the radius occurred within one inch of the lower articular surface in 97 per cent. of the cases. Posterior displacement of the lower fragment was present in 61 per cent.,

undoubted impaction in 27 per cent. By "posterior displacement" is understood marked alteration in the contour of the bone; practically all of the cases showed some alteration in the plane of the lower articular surface, with the exception of fractures of the radial styloid, which were present in 18 per cent.

Some part of the ulna was injured in 50 per cent. of the cases in this group. These injuries affected the styloid in 46 per cent., and the shaft in 9 per cent.

The carpal bones showed injury in 4 per cent. These injuries were equally divided between scaphoid and semilunar, and consisted in fracture, except for one dislocation of the semilunar, associated with a fracture of the radius.

Table II gives a summary of these figures.

TABLE II

Cases in Which Epiphyseal Union is Complete

A. Radius:	
Injury present in	92 per cent.
Radius alone in	45 per cent.
Radius with ulnar styloid in	43 per cent.
Radius with ulnar shaft and styloid in	3 per cent.
Fracture within one inch of lower end in	97 per cent.
Posterior displacement	61 per cent.
Impaction	27 per cent.
B. Ulna:	
Some part injured in	50 per cent.
Injury at styloid in	46 per cent.
Injury to shaft in	9 per cent.
C. Carpal bones:	
Injury present in	4 per cent.
D. Metacarpals	no injury.

Discussion.—Upon comparing these figures for the two groups of cases, we find some striking differences in the fractures about the wrist between those cases under the age of twenty, before union of the epiphysis has taken place, and those over twenty, after this union has occurred.

In both groups, the radius is most constantly and most frequently injured; the ulna likewise shows frequent injury in both. But here the similarity ends, and a wide divergence in type of fracture begins to make itself manifest.

Below twenty, the most common injury to the radius is a transverse fracture, together with a transverse fracture of the ulna, within two inches of the lower articular end of the bone, and with dorsal displacement of both lower fragments. In most cases, the fracture is about one inch from the lower end; at any rate, well within the two-inch limit.

Above twenty, on the other hand, the overwhelming majority of fractures of the radius are within one inch of the lower end of the bone, and while the ulna is also very frequently the site of fracture, in practically all of the cases, this consists in a fracture of the styloid process, the shaft being injured in but few cases, and it is my opinion that these latter cases are due to direct violence.

As is to be expected, incomplete or so-called "greenstick" fractures are found exclusively in the group under age twenty; the same is true of injuries to the epiphysis, as such.

These findings agree perfectly with those of others who have studied similar series of cases, and they establish two definite forms of injury at the wrist-joint, depending upon the age of the patient, each form of which may be said to be typical for that age group.

Under age twenty, before union of the epiphyses has taken place, the most frequent form of injury is a transverse fracture of both radius and ulna about one inch, or within two inches of the lower ends of the bones, with backward displacement of both lower fragments.

Above age twenty, after union of the epiphyses, the most frequent form of injury is a transverse fracture of the radius within one inch, and most frequently about one-half inch above the lower end, with posterior displacement and impaction of the lower fragment, associated in nearly half the cases with a fracture of the ulnar styloid. Here also are found injuries to the carpal bones.

FRONTAL FRACTURES OF THE PATELLA

By Steele F. Stewart, M.D.

of Los Angeles, Cal.

From the Orthopædic Clinic, Los Angeles General Hospital

Frontal fractures of the patella are exceedingly rare, if one may judge from the literature. Only two cases have been found after a diligent search. Kroner [1] reported the first case in 1904.

Case I.—A female aged thirty-one, was running rapidly over smooth ground when she suddenly felt a severe pain in the left knee; she fell, and was unable to rise. The left knee was much swollen, active motion was absolutely impossible, and attempts at passive motion were painful. The patella was felt more over the lateral condyle than normal, but there was also a bony fragment on the outer side of lateral condyle. Between these two fragments there was an oblique diastasis. It was diagnosed as a dislocation and fracture of the patella. About one week later, an unsuccessful attempt was made at reduction. An open operation was then attempted. Through a mesial incision the knee-joint was exposed, and a fracture of the patella in the frontal plane was found. One fragment consisted of the cartilaginous portion of the patella, and the other was bony. The cartilaginous fragment was displaced laterally and was firmly caught on the lateral surface of the external condyle, and from the sketch it would appear to have been in nearly a sagittal plane. The bony fragment was more nearly in the normal position, but was somewhat tilted upward. The fragments were replaced and sewn with through and through sutures. One month later, the patient was able to bend the knee to a right angle without pain.

Case II.—Kleinberg [2] in 1923, reported a second case which belongs in this category, although it is not as marked as the case of Kroner. A male aged eighteen years, was thrown during a football game. He experienced severe pain in the left knee and was unable to rise. There was no evidence of external violence, but there was marked and immediate swelling of the knee. The knee remained painful and he was unable to move it actively. Passively, there was some painful motion. The swelling was due wholly to an effusion into the joint. The patella was normal to all clinical examinations except that it was sensitive. All the patellar ligaments were apparently intact. A Röntgen examination in the lateral view showed three fragments lying between the patella and the femur, and over the intercondylar notch and the mesial condyle. The articular surface of the patella was more concave and more irregular than normal. Ten days later, through a split patellar incision the fragments were brought into approximately normal relationship to the patella, and were fastened in place by sutures through the quadriceps and patellar tendons. A plaster case was applied, and passive motion was begun in about ten days.

Author's Case.—The present case (Los Angeles General Hospital, 212004), is that of a woman aged forty-eight, who was admitted to the Los Angeles General Hospital, July 7, 1924, her chief complaint being pain and swelling of the left knee during the two days previous. On July 5, the closed car which the patient was driving was wrecked in collision with another car. She was unable to state exactly what happened, but she knew she was not thrown from the car, for she got out of it herself and helped to take care of other injured persons. After caring for them, she fainted. On return of consciousness, the left knee was stiff and painful, and was most comfortable in extension. Swelling set in at once. She received emergency treatment for lacerations above the right eye and for multiple bruises.

Upon examination the patient was found to be a slight woman, whose average weight has been about 125 pounds. There was a laceration above the right eye, which had been stitched, and there was considerable periorbital ecchymosis. There were bruised areas over the calves, elbows, and forearms. She was moderately knock-kneed. The left knee was markedly swollen and ecchymotic, all land marks being obliterated. There was a slight abrasion on the inner surface of the knee. A patellar click could be obtained. There was acute tenderness over the patella. Flexion caused increased pain, but no crepitation. The laboratory examinations were negative. The X-ray examination showed a frontal fracture of the patella in good approximation (Fig. 1).

One week later, the writer was called in consultation by the resident physician, Doctor Hohanshelt. At this time the swelling had partly disappeared from the knee, but there was still tenderness along the inner border of the patella. No crepitus could be elicited. Attempts at flexion were extremely painful. The patient could, however, hold the knee extended, and all patellar ligaments were intact, though very lax; the patella of the other knee exhibited the same degree of laxity. An adhesive dressing was applied to the knee to prevent the extremes of motion, and the patient was permitted to walk in about two weeks.

Two months later, an examination showed that the patient walked with a slight limp, holding the knee rather stiffly. The knee could be fully extended actively. Flexion was possible to about 110 degrees before any pain was experienced. There was very slight tenderness aroun1 the patella.

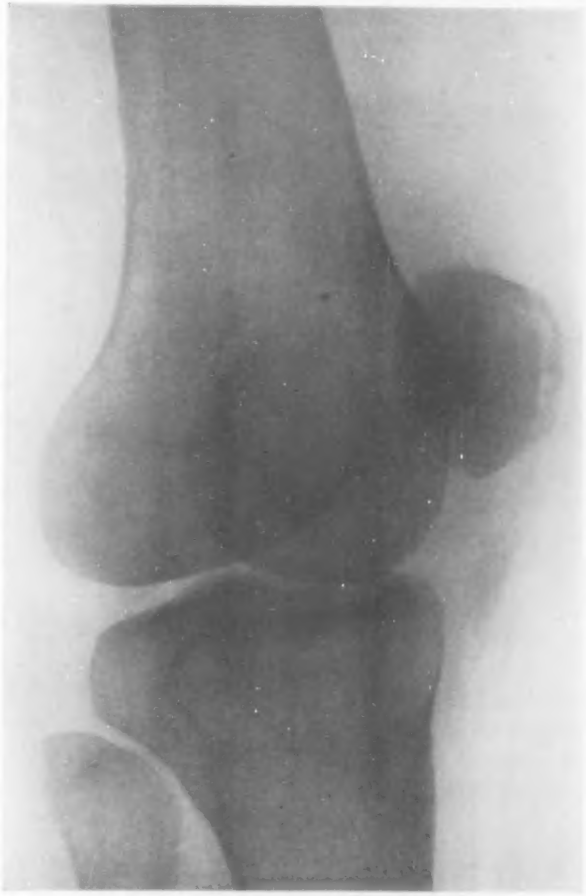

FIG. 1.—Fracture of the patella in frontal plane, by which the anterior surface of the patella was sheared off. Note the oblique position of the knee which made possible the demonstration of the fracture.

Diagnosis.—The detection of this condition may offer no small amount of difficulty. Physical examination may suggest the possibility of a fracture or one might be led to the belief that one of the more common internal derangements of the knee was present, or that only a severe strain of the peri-patellar ligaments had occurred. Röntgen examination should be secured in all cases, although different methods for this examination may be necessary. In a case where only the articular cartilage has been sheared off, either

in whole or in part, an ordinary X-ray might be extremely inconclusive or even misleading. If this is suggested, the aspiration of the joint followed by an injection of air, carbon dioxide, or oxygen would in all probability throw the offending part into relief. In fractures such as the one that has just been described, a true lateral of the knee might be deceiving owing to the slight separation which may occur. In such cases one should make an X-ray in a slightly oblique direction as shown in the accompanying illustration.

Mechanism.—In none of these cases does the history clearly delineate the mechanism of this fracture. Kroner's [1] case seems to furnish the clue. He believed that there was first a lateral dislocation of the patella which caused the patient to fall on its projecting mesial border, thereby fracturing the same in a frontal plane. The cartilaginous fragment was caught and firmly held by the lateral condyle, while the anterior fragment was returned towards its natural position by the quadriceps. Considering the other cases, it would seem that a more logical explanation can be obtained.

The following premises are held to be well substantiated by authority.[2] Fractures of the patella are caused chiefly by muscular action. In a total dislocation of the patella, it becomes caught on the lateral femoral condyle, while in a subluxation, it is held against the lateral surface of the mesial condyle in the intracondylar notch.

In two cases it is known that the patellar ligaments were intact. In the case that is here reported it is known that the knee was flexed, and probably against very notable resistance, *e.g.*, sudden depression of the clutch, and that the patient was knock-kneed, two conditions which are favorable to the production of a dislocation of the patella. In the other two cases one cannot be sure whether or not the knees were flexed at the time the accident occurred nor was any observation recorded as to the existence of knock-knees. Reasoning from these facts, one is led to the belief that any one of these fractures might have been caused in the following way: A partial or complete luxation of the patella occurred without rupture of its lateral ligaments; the knee-cap was caught in one or other of the places mentioned, and the powerful contraction, chiefly of the vastus medialis, caused a shearing off of a portion of the patella in the frontal plane.

Prognosis.—Each case has had a return of normal function or practically normal function within a period of one to two months, so that it would seem that a favorable prognosis could be given in fractures of this type.

Treatment.—These three fractures represent the three possible types of frontal fractures of the patella: (1) A complete frontal section; (2) frontal section which extends posteriorly into the joint; (3) frontal fractures extending anteriorly. The latter case would apparently require no operative treatment, but would be held sufficiently by a posterior splint with adhesive. An unreduced fracture, as is represented by the other two cases, would certainly demand arthrotomy and treatment according to local indications.

Conclusions.—Such a small number of cases permit of no very definite conclusions. The following are suggested as possible:

(1) It is a fracture of adult life; (2) it is more frequent in the female—probably due to the greater frequency of knock-knees among women, and their greater liability to recurrent dislocation of the patella; (3) it is associated with severe muscular action rather than direct trauma; (4) it leaves a knee which functions very well.

BIBLIOGRAPHY

[1] Kroner: Ein Fall von Flächenfraktur und Luxation der Patella. Duet. Med. Wochenschrift, vol. xxxi, June 25, 1905, p. 996, also Centralblatt f. Chir., 1904, p. 1469.

[2] Kleinberg: Vertical Fracture of the Articular Surface of the Patella. Jr. A. M. A., vol. lxxxi, Oct. 6, 1923, p. 1205.

[3] Stimson: Fractures and Dislocations, New York, 1917.

TRANSACTIONS
OF THE
PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held October 6, 1924

The President, Dr. E. B. Hodge, in the Chair

COMPOUND FRACTURE OF THE OLECRANON ASSOCIATED WITH FRACTURE AT WRIST

Dr. Hubley R. Owen presented a man, who was admitted to the Jefferson Hospital, January 31, 1924, with an elbow and wrist swollen, and there was a nasty contused wound with considerable devitalization of the tissue around the olecranon. The swelling delayed operation for ten days. He then made an open reduction and sewed the olecranon fragments together with kangaroo tendon. Passive motion on the elbow was begun in ten days after operation. The fracture at the wrist was reduced at once after admission. The patient now has almost 100 per cent. function; except for some slight deformity, the function of the wrist is excellent.

UNUSUAL URINARY CALCULI

Dr. Alexander Randall presented specimens obtained from a man, aged sixty-three years, who entered the University Hospital complaining of burning on urination and marked frequency. In 1911 he was operated on for stone in the bladder by a suprapubic cystotomy; at this operation a group of small stones were removed. In 1918, a second suprapubic cystotomy was performed for recurrent calculus. At this operation a single large stone was removed. In April, 1924, he had an operation for a large incisional hernia, which was successfully repaired under great difficulty due to the size of the hernia and the adhesions present. X-ray at that time revealed the recurrence of vesical calculi, but no attempt was made to remove the same. Following his recovery from the above operation, the patient was transferred to the Urological Service for the removal of his vesical calculi. Due to the unusual size of the stones and the small contracted bladder which was present, it was considered good policy to first attempt a litholopaxy in an effort to either remove the stone entirely by that operation, or at least reduce the mass to a size commensurate with perineal lithotomy. Therefore, May 17, under light gas anæsthesia, a litholopaxy was performed. This was repeated the following week, May 23. Following this the patient was sent home for a period of recuperation. He returned July 18 for his major operation. During this period he had passed large quantities of fragments. After a few day's study, a perineal lithotomy was performed July 22. There was no prostatic hypertrophy found, but it required an extensive resection of the posterior urethra, with ultimately two incisions of the vesical orifice in order to remove two large calcareous fragments found to be in the bladder cavity. These were successfully delivered, as well as numerous smaller pieces. The patient voided through his urethra on the thirteenth day following his operation, and the perineal wound had healed by the fifteenth day. He left for home on the seventeenth post-operative day. He was seen five weeks later, and found to be in excellent shape: his frequency amounted to

twice per night; there was no residual urine, and a No. 28 French sound passed to the bladder with ease.

DOCTOR RANDALL gave also the history of a man, twenty-five years of age, who was admitted to the University Hospital, May 29, 1924, suffering from retention of urine. At the age of eight years he was run over by a wagon, suffering a fracture of the pelvis and apparently a rupture of the posterior urethra. He was operated on shortly after the accident, and a urinary fistula established in the perineum, since which time, now seventeen years, he has urinated only from this opening and never per meatus. During these seventeen years he has had periodic trouble with retention of urine and frequently had to relieve himself by sitting in hot water. Two years ago, during an acute spell of retention, he was placed in the hospital, but does not recall that anything other than local attention was necessary; no operation being performed. In January, 1923, he was a patient in this hospital again for acute retention. He was catheterized through this fistula and drained, and refused at that time any operative interference. During the past three years he has had recurrent attacks of chills and fever at irregular intervals. On the morning of May 29, 1924, another attack of acute retention brought him to the hospital, accompanied by great pain in the hypogastric region. The swollen bladder formed a hypogastric tumor extending two-thirds of the distance towards the umbilicus: the penis is small, atrophic; in the midline of the perineum there is a pinhole opening through which urine is oozing slowly. A filiform was passed into his bladder through the fistula and with this as a guide a small Gouley catheter was passed with great difficulty and a large quantity of foul ammoniacal urine removed; the filiform was left in for drainage. Immediately following this instrumentation, the patient had a marked chill lasting several minutes. Two hours later he again complained of pain in the bladder region and a small woven catheter was successfully passed and a little over 100 c.c. of cloudy urine removed, giving relief. The catheter was left in place. During the succeeding ten days attempts were made to dilate the perineal fistula by increasing the size of the indwelling catheter. Finally it was possible to pass a metal sound, which elicited a characteristic grating sound of a calculus, and X-ray demonstrated a large vesical calculus and several smaller ones, pelvic bones showing evidence of old injury. Owing to the intense pain the patient suffered during any attempt at instrumentation, the persistent elevated temperature and the leucocytosis, a suprapubic cystotomy was performed, June 11, 1924; bladder cavity found to be small and contracted, with markedly inflamed mucous membrane, but without any calculus. On passing the finger into the posterior urethra, a stone was felt external to the internal sphincter, and lying in the prostatic urethra. Being impossible to retract the calculus through the sphincter, it was crushed *in situ* and removed in fragments, followed by copious lavage: the bladder was closed about a suprapubic drain. The patient was then placed in lithotomy position; the perineal fistula was dissected to its passage through the triangular ligament; the proximal end of distal urethra was found to be completely closed; it was opened and an end-to-end anastomosis attempted over a No. 14 French catheter, after which the perineal wound was closed with a gauze drain in place.

During the succeeding four weeks the patient had a remarkably septic temperature, ranging from 99 to 104.6. Following one severe chill on June 24, a temperature of 105.4 was recorded. During this time his suprapubic drain functioned ideally and he was eliminating in excess of 3000 c.c. daily. His

perineal wound did not heal and it was generally pussy. Daily irrigations with sounding at intervals were given.

During the succeeding month the general condition of the patient exhibited a profound sepsis to overcome which, two intravenous 1 per cent. mercurochrome infusions were given, and three blood transfusions, and finally an intravenous injection of gentian violet, all with little influence on the patient's condition. Death occurred August 17, sixty-six days after his first operation. At autopsy there was found a diffuse low grade suppurative pelvic cellulitis without abscess cavity formation and without involvement of the peritoneum; there was likewise a low grade suppurative pyelonephritis more marked on the left side with marked thickening of the pelvic walls, the condition evidently one of long duration, probably developed during his period of urinary straining in the years gone by with moderate exacerbation since operation. Both ureters were dilated and chronically inflamed. The only actual pus was found in the sheath of the left rectus muscle, probably having its origin during the last ten days of life, when proper care of his suprapubic wound was difficult. The seminal vesicles were normal. The cavity in the prostatic urethra from which the calculus was removed, though found at autopsy to be coated with pus, had under this a granulation tissue surface showing a moderate amount of healing, and of course was daily cleansed by urine and irrigation when dressed, as drainage of it was both pendant and free. There was one pocket off of this cavity that admitted the tip of the finger, in which was found a small residual fragment of stone, though communication with the larger cavity was open. Remaining abdominal and thoracic viscera were negative.

Dr. A. P. C. Ashhurst said that on August 1, last, he found a man in the ward of the Episcopal Hospital who was said to have a carcinoma of the prostate. On inserting his finger into the man's rectum he felt a hard prostate apparently inoperable. Three days later, however, it was reported that the man had not passed urine since the night before, that efforts to pass a catheter had failed, and that he was in great pain. The reporter tried to catheterize him and could not get any flexible instrument to enter the bladder. He then tried a metal catheter and struck a stone. Although the man was in very bad shape (uræmic and septic), he decided to operate. He cut down in the perineum on the end of a sound and found a stone (8 by 4.5 by 4 cm.) impacted in the urethra and behind that a second stone (4.5 by 4 by 3 cm.), also in the urethra. There was much pus. On putting the finger in the rectum the carcinomatous prostate had vanished! It was apparently a normal prostate. The man was fifty-two years old, and he died seventeen hours after the operation.

Gross, in his *System of Surgery*, states (1872) that Sabatier referred to a case where an urethral calculus was found weighing three ounces, and that Duméril had seen one which was nearly three times as heavy. These two specimens shown together weighed over six ounces.

SEVERE ELECTRIC BURN COMPLICATED BY TETANUS

Dr. Hubley R. Owen reported the case of a fireman in a neighboring city, who, August 9, while at a fire with the nozzle of the hose in his hand, came in contact with a high-powered wire. His hand was immediately thrown

into tonic convulsion; he maintained his grasp of the nozzle and was unable to release, his hold. His fellow firemen had to knock the nozzle from his hand. When seen by Doctor Owen the man had a moist gangrene half way up his forearm. His hand was still in contracture, so that he could not possibly straighten out his fingers. He remembered a case four years ago in which they were puzzled to know how a man met his sudden death while under a trolley; the question arose as to whether it was due to natural causes or to electric shock. Doctor Wadsworth was called in consultation and demonstrated the marked rigidity of the muscles, contracted by the shock of the electric current. Doctor Owen noted the difference in the rigidity of the muscles of the lower and upper extremities. In the case he was now reporting, he advised immediate amputation. Forty-eight hours after the operation the man developed the first symptoms of tetanus, from which he died. The only other case lost in the Police and Fire Departments of Philadelphia was from tetanus, following a burn. This case was back in 1883. In his work in the fire department, he made it a rule to give tetanus antitoxin as a prophylactic, not only in burn cases, but in cases where there was devitalization of the tissue. In the Cooper Hospital, of Camden, there is hardly a week goes by that they do not have a death by tetanus. This is not to be wondered at, when one realizes that they draw their cases from an agricultural district. He thought that more stress should be laid on the use of antitoxin in civil practice.

Dr. George M. Dorrance said that tetanus was endemic in the locality of Camden. There had been one case in the St. Agnes Hospital which came from Camden. It was a case of compound fracture which occurred in the man's house. He had been interested in watching the results with the employees of the Campbell Soup Company, of Camden, where they have been giving a lot of tetanus antitoxin and where there had been no tetanus. In his opinion the disease is probably caused by the soil coming from the river.

PERIRENAL HYDRONEPHROSIS WITH COMMENTS ON THE TECHNIC OF ABDOMINAL EXTRAPERITONEAL NEPHRECTOMY

Dr. Benjamin Lipshutz read a paper with the above title, for which see page 498.

Dr. Leon Herman was reminded of a woman who was admitted to the Pennsylvania Hospital with a large mass in the left upper abdomen. On differential kidney study it was found that the function on the side of the mass was about the same as that on the side of the supposedly healthy kidney, both being within normal limits. This of course suggested that the mass was of extrarenal origin and probably not connected at all with the kidney. A pyelogram showed that the left kidney pelvis was lying transversely across the body of the first lumbar vertebra, and that the left ureter had been displaced across the vertebral column, so that it was lying parallel and almost in apposition with the right ureter. The diagnosis was of a left-sided retroperitoneal mass with displacement of the kidney. Doctor Klopp operated transperitoneally, removing a cyst the capacity of which was 1300 c.c.

The speaker could not see how a case of this kind could be diagnosed with certainty; it may be determined that the mass is connected with the kidney, but this is as far as one can go in diagnosis. In the case referred to, the

cyst was loosely connected with the kidney and could be peeled off and had caused only slight pressure atrophy of the renal substance. Experience with this condition is limited, since simple serous cyst of the kidney is an extremely rare lesion. In such a case the abdominal extraperitoneal method has much to recommend it, especially in these cases in which the diagnosis is uncertain.

Stated Meeting Held November 3, 1924

The President, Dr. E. B. Hodge, in the Chair

REMOVAL OF SCREWS AND PLATES AFTER INSERTION IN BONE

Dr. A. P. C. Ashhurst read a paper with the above title, for which see page 528.

THE RELIEF OF PAIN IN CARCINOMA OF THE FACE

Dr. Francis C. Grant presented a paper with the above title, for which see page 490.

Doctor Ashhurst said that in these cases he occasionally injected the branches of the fifth nerve for pain in the face, but when inoperable carcinoma occurs in the neck, the only thing he had done was to burn the greater part of the carcinoma off. Doctor Fay has divided the upper cervical roots intradurally and thus relieved the pain in the neck. But cautery excision is a simpler procedure. When one takes off the top of a carcinoma of this kind the patients get immediate relief from pain and live in comparative comfort. The immediate relief of the pain is as striking as when a carbuncle is excised. But this relief does not last forever. The patients have an open sore, of course, but this can be radiated afterwards.

Dr. George M. Dorrance said that the method described by Doctor Grant had been used in Blockley Hospital for two or three years. He now had a case there who has had carcinoma of the jaw for seven years. He has had no recurrence of sensation since the injection. He thought the time during which they are free from pain following the injection is longer than that stated by Doctor Grant one year. He had seen one case which lasted eleven years after the first injection, another, nine years, and another seven years. On the other hand, he had seen a case in which sensation returned in nine months. However, this was quite exceptional. After an injection one should wait for several weeks to see whether the nerve had been really reached or whether the alcohol was merely injected around it. The duration of freedom of pain depends on whether one has gotten the nerve itself or only the area surrounding it. If, one month after injection, there is anæsthesia, the chances are it will last well over a year.

Dr. Francis C. Grant rejoined that Doctor Ashhurst was quite correct in his statement that cautery excision of a malignant growth about the face will relieve the pain in some cases. In other cases, the pain is not relieved and in every case, no matter how treated, the repeated dressings are extremely painful. It is this suffering particularly, that may be relieved by the alcoholic

injections. These patients have suffered to such an extent that they dread the dressing of the wound, and it is difficult to keep up their morale sufficiently to have them willing to return for the proper after-care. If there is further after-treatment, such as the insertion of radium needles, that may be all done painlessly following nerve block.

As to cases in which the lesions lay below the trigeminal distribution, he mentioned a case treated by Doctor Fay, in which the posterior roots of the first, second, third and fourth cervical nerves of one side were cut within the spinal canal. The results in this case were brilliant. The operation is not a difficult one to those versed in the surgery of this region, and produced in this case complete relief. This suggestion of Doctor Fay's seemed to him to be highly practical and to afford a method for the relief of pain in malignant tumors of the neck.

As to relief following alcoholic injection which lasted for so long a period as nine years, he has not seen the relief, resulting from peripheral injection, last for as long a time in this series of cases, because sufficient time has not elapsed since injection—but it has been his experience with the peripheral injections for the relief in major trigeminal neuralgia that he has not been able to inject the peripheral nerves and have the anæsthesia last much longer than three years. Possibly, if one injects the ganglion itself, the relief may be more permanent.

THE TREATMENT OF SUPERFICIAL BURNS

Dr. I. S. Ravdin presented a paper with the above title, for which see page 439.

Dr. James H. Baldwin said that in the matter of contractures and how to treat them, one of their greatest problems was presented by contractures of the knee, elbows, etc. He asked Doctor Ravdin what method he had used to prevent contractures. He noticed that none of his patients shown had any. All are more or less familiar with the Parker method—giving the patient anæsthesia, if necessary, and straightening out the joint, then covering the raw areas with Zno plaster, replaced twice a week. Next a gauze dressing changed daily, then a plaster splint to maintain extension. He had had some patients who had done well with this method; others had not. A great many of these cases were seen at the Methodist Hospital, where they were treated with wet salt solution dressings, and when pain had been relieved, they were put under the electric light. Just as in Doctor Ravdin's patients, they find the new skin soft and pliable usually, although somewhat discolored.

Dr. Hubley R. Owen said that these burns ought to be classified and treated as wounds. In bad cases of burn, one ought to do a débridement and not only that, but the dressings should be done under general anæsthesia. He had never tried local anæsthesia. When re-dressing is associated with great pain, it ought to be done under an anæsthetic. When any infection is present, the case should be treated as a wound, and if it is not too painful,

after protecting the skin and surrounding parts, Dakin's solution should be used rather than dichloramine-T.

Dr. George M. Dorrance remarked concerning the importance of sleep in these burn cases during the first twenty-four hours and the statement that if these patients do not sleep during the first twenty-four hours following the burn, they will die; that at the St. Agnes Hospital, where were received quite a number of burn cases, coming from the oil works, they had found this to be literally true. If the case sleeps for the twenty-four hours following the burn, he will usually recover. Since Doctor Owen called it to his attention three or four years ago, he had been dissecting out these burn wounds. In some cases he practised too much dissection and got into difficulties, but lately he had been drifting back to it again and think it is well to take a deformity rather than death.

Dr. W. Hersey Thomas said that he had found it a helpful thing, not in very extensive burns, but in those involving portions of the extremity, to treat the cases as one would treat frostbite. He had kept them in a cold (?) water bath for twenty-four hours; it soothes the patients greatly.

Dr. I. S. Ravdin (closing discussion on his paper) said that in the case of second degree burns, he practised simple removal of the necrotic skin, which is a partial excision. In cases where there is charring, after twenty-four hours he practiced really a débridement, removing almost everything that has been injured by the burn. He emphasized the point that in sleep during the first twenty-four hours lies the hope of the patient. If one can carry them over the initial period of shock, they have a chance. If not, they will die of toxæmia.

Several years ago he had a case of a child in which two-thirds of the body surface was burned, who lived nearly sixty-seven days after débridement. The question in this case was that of making a skin graft over a large area and as the child was very young she practically died of exhaustion, because they were not able to skin graft her rapidly enough.

As to contractures, he had not said much in his paper, because the primary interest is in carrying the patient over the initial period of toxæmia, since eighty or ninety per cent. of deaths occur during that period. The thing to do to prevent contractures is to use a Thiersch or other graft with extension to keep the surfaces in proper position.

SPONTANEOUS RUPTURE OF GANGRENOUS URINARY BLADDER

Dr. E. L. Eliason presented a woman aged thirty years, who was admitted to hospital July 21, 1920, on account of pain in the lower abdomen, of two days' duration. Patient says she was well until two days ago, when she was suddenly seized in the morning with sharp abdominal pain. The pain was not confined to any particular part of the abdomen and she did not vomit until the next day, when she vomited several times. When admitted she was suffering from no pain, but her abdomen felt sore, particularly on the right side. She has no unusual urinary symptoms during this attack except the first day, when she was catheterized by her physician. She had a tuber-

culous right kidney removed five years ago at the Presbyterian Hospital and since then she has had frequency of urination, having to get up several times each night.

Inspection of the abdomen revealed slight rigidity in the lower right quadrant, especially in the rectus muscle, with tenderness over the lower abdomen on both sides, but chiefly on the right. Rectal examination shows a rather marked tenderness and a feeling of fulness on the right side. The uterus and adnexa appear to be slightly more fixed than normally. Temperature, pulse and respiration, 103.1, 124, 32. White blood-cells, 10,000. Urine analysis (catheterized specimen) loaded with white blood-cells.

Through a McBurney incision the abdomen was opened, disclosing a low grade peritonitis and an excessive amount of slightly turbid fluid resembling, in appearance and odor, infected urine. The appendix was delivered and found covered with exudate. It was removed and in the absence of interstitial inflammation, further search was made for the cause of the peritonitis. Examination in the pelvis revealed a walled-off mass covered by numerous knuckles of small gut, which were glued together by recent adhesions. Finger separation of these resulted in a gush of several ounces of fluid similar to that disclosed in opening the abdomen. Retraction disclosed to view a dark mass of tissue in the centre of which was a small opening discharging what proved to be urine. A midline incision was made and it was found that the sigmoid had become attached to this dark mass of tissue which proved to be bladder and was invaginated into the bladder in this way, attempting to plug off the gangrenous fundus. The small puncture wound existed just to the right of this invagination. By gentle manipulation the sigmoid was freed, and it was then seen that the entire fundus of the bladder was lifeless and necrotic, tearing when instrumental attempt was made to relieve the invagination. The gangrenous area was excised, which resulted in a removal comprising the entire fundus of the bladder down to the peritoneal reflection on the upper anterior aspect. The peritoneal edges of the abdominal incision were now sutured around the edge of what was left of the bladder, thus marsupializing this viscus. Drains were placed in both incisions and the wound partially closed. A permanent catheter was placed within the urethra.

Post-operative Notes.—The patient had a rather stormy career for a few days, but at the end of the third day her temperature dropped to 99.2 and pulse to 90. She continued to run an afebrile course for the extent of her stay in the hospital to September 27. Her wound gradually healed, leaving a small suprapubic urinary fistula, for which she was fitted with a rubber urinary receptacle. Some days later this fistula healed and the patient was discharged from the hospital. A subsequent history reveals the fact that her urinary fistula had returned and has closed and opened at various times. The woman has gained in weight from fifteen to twenty pounds.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

Stated Meeting Held October 22, 1924

The Vice-President, Dr. Walton Martin, in the Chair

GANGRENE OF COMMON BILE DUCT

Dr. John A. McCreery presented a man, age thirty-two, whose past and family history was irrelevant except for a somewhat indefinite statement that for several years his eyes had been slightly jaundiced. From March to June, 1923, he had had four or five attacks of epigastric pain coming on shortly after eating, such attacks lasting four or five hours, not accompanied by vomiting. At one examination during this period it was noted by Doctor Knapp that his liver was enlarged, the lower edge being probably 1½ inches below the costal margin and slightly tender. Otherwise, aside from scleral jaundice and slight epigastric tenderness, examination was negative. A gastro-intestinal X-ray series at this time showed no abnormal conditions.

After this for about nine months he was free from symptoms although always presenting a slight scleral jaundice. In March, 1924, he had a much more severe attack which seemed to be a typical biliary colic. Jaundice was definite but never that of complete obstruction, while the stools were at all times normal in color. Twelve hours after the onset his blood count was 12,000, with 27 per cent. polymorphonuclears. This attack persisted without intermission for thirty-six hours, at which time there was definite rigidity in the right upper quadrant. Operation was performed on a pre-operative diagnosis of stones impacted in the cystic duct. On opening the peritoneum several ounces of bile-stained fluid were found in Morrison's pouch and in the right lumbar gutter. This was found to be coming from a small area of gangrene in the common bile duct about one-half inch above the head of the pancreas. The duct itself was not dilated and no stone could be felt. The gall-bladder was not dilated, its surface somewhat congested, its wall of normal thickness. It emptied easily on slight pressure. When opened it contained dark bile, and no stones were found. The pancreas was not enlarged and seemed to be normal in consistency. There was œdema of the retro-peritoneal tissues in the lesser omentum, and in the gastro-colic omentum. The peritoneal surface in this region, as well as the omentum, lower surface of the transverse mesocolon, and the peritoneum, lateral to the ascending colon, were studded with yellowish nodules, apparently the lesions of a miliary fat necrosis. There were no gross changes in the liver. Under the circumstances the relief of pressure seemed the wisest procedure. This was done by a chole-cystostomy, together with drainage of Morrison's pouch.

The patient's condition for about eight days was satisfactory, but at that time he developed the physical signs of a sub-phrenic abscess, and an X-ray picture showed a high immobile diaphragm with an obliterated costo-phrenic space. Operation for sub-phrenic abscess was performed ten days after the first operation, and it was found that the sub-phrenic space was clear, but that

there was a sub-hepatic abscess which had apparently pressed the liver upward. After drainage of this abscess convalescence was slow but uneventful, the wounds healing and the patient leaving the hospital seven and one-half weeks after the original operation.

Examination of tissue removed from the omentum showed the typical lesions of fat necrosis. Cultures of the bile in the peritoneal cavity and of the gall-bladder bile, taken at the time of operation, were negative. The culture from the secondary abscess showed a streptococcus. In view of the fat necrosis, the bile was tested for pancreatic ferments, which were not found, and because of the preëxisting jaundice and the suggestion that the original condition might have been a hæmolytic jaundice, fragility tests of the red corpuscles were done but with negative results. The patient has been under observation for six months, since his discharge from the hospital. He has had no recurrence of his colic, and the jaundice which was present during the nine months previous to operation has disappeared. At no time has his spleen been palpable.

While perforation of the gall-bladder had not, in his experience, been uncommon, perforation and gangrene of the common duct is extremely rare.

It is possible that a stone was the direct cause of pressure necrosis. However, there was never any evidence of complete biliary obstruction, and it would seem that a stone large enough to have caused pressure necrosis should have been recognized at operation.

The case is presented as of interest in that it is an example of a rare complication of biliary tract disease.

MULTIPLE CYSTS OF THE LIVER

Dr. Constantine J. MacGuire, Jr., presented a woman, fifty years of age, who was admitted to the First Surgical Division of Bellevue Hospital, October 5, 1922. She had always been strong and healthy with the exception of an attack of jaundice during child-birth fifteen years ago. For several months previous to admission, she had noticed an increasing distention of her abdomen, with the sense of pressure in the epigastrium and right upper quadrant. Two weeks before admission, she suffered from sharp pains in the right upper quadrant, radiating to the right flank. The laboratory findings were all without significance.

On examination, two large round, hard masses could be felt, one extending from well below the umbilicus up to the ensiform, and the other just lateral to this in the left flank. The liver edge came four fingers below the costal margin. It was smooth, hard, and well defined. The masses did not fluctuate and there was no hydatid thrill.

October 10, she was operated upon through a very long median incision, and it was found that the masses arose from the visceral surface of the liver. The larger arose from the region of the falciform ligament, and contained at least one litre of thin, clear yellow fluid. Arising from the visceral surface of the right lobe and left lobe were similar masses almost as large, and then dwindling down to microscopic size were hundreds of smaller cysts, most numerous around the hepatic ducts. The walls of these cysts were very thin and translucent. The larger cysts were quite spherical, one hemisphere occupying a corresponding concavity in the surface of the liver and the other half protruding into the peritoneal cavity. The cyst wall was entirely removed from the protruding portion of all the large cysts, but the cyst wall lining the

concavity in the surface of the liver could not be removed, as any attempt to do this was associated with too much bleeding. The smaller cysts were simply punctured. The patient made an uneventful convalescence, and up to the present time has had no recurrence of the masses or of the pressure symptoms from which she was suffering.

The pathologist's report showed that the cyst wall was lined with a single layer of cuboidal epithelium, while the contents of the cyst showed no cholesterin, no bile, a moderate amount of sodium chloride and a large amount of albumin.

These findings led to the diagnosis of simple, congenital cysts of the liver, due to malformation of the primitive biliary capillaries.

These cases are quite rare, and in the literature, they are described as usually associated with cysts of the kidney.

DISLOCATION OF KNEE WITH RUPTURE OF ANTERIOR CRUCIAL LIGAMENT

Doctor MacGuire presented a girl of twenty-four years who was admitted to the First Surgical Division of Bellevue Hospital, January 11, 1923, with an injury to the right knee received in an accident the same day. On examination, it was found that the tibia, fibula and patella were dislocated laterally on the femur. The soft parts on the inner side of the joint had been drawn in between the tibia and inner condyle of the femur, so that they were pinched and under great tension, with a great deal of discoloration, and it looked as though these soft parts might become gangrenous. X-ray showed no fracture. Two attempts at reduction under a general anæsthetic failed, the failure being due to inability to release the soft parts from their position between the joint surfaces. A semilunar incision was then made over the inner surface of the joint. The internal lateral ligament was found completely ruptured as was the capsule of the joint. The inner condyle had protruded through the tear in the capsule so that the lower portion of the capsule with its attached lateral ligament and the internal meniscus were forced out almost into the intercondylar notch; until the internal condyle was milked back through the opening in the capsule, the meniscus could not be reduced, and this had been the bar to closed reduction. On increasing the dislocation and abducting the leg a very clear view of the crucial ligaments was obtained and it was seen that the anterior crucial ligament was completely torn across just above its attachment to the tibia.

On reducing the dislocation, the two ends of the anterior crucial ligament were approximated, but were lost to view so that no attempt at suture could be made. The ligamenta alaria and mucosa were black and macerated, and a cloudy, oily fluid was running from the joint. After reduction of the dislocation, the capsule was sutured and the internal lateral ligament repaired. Considerable lateral mobility still existed, but there was not the hyperextension that one would expect with the division of the anterior crucial ligament.

The limb was kept immobilized for about seven weeks in about 135° of extension. At this time she got up and walked on the leg against orders, but with no apparent damage. Six months later, she was seen at the Follow-up Clinic. There was no abnormal lateral mobility, and the joint seemed as sound as that of the other side.

Because of this case, he had made some resections of the knee-joint and had found that division of the anterior crucial ligament was not associated with hyperextension. He did not believe that the anterior crucial ligament

is as essential a part in maintaining the stability of the knee-joint as has been thought, and doubted if elaborate operations, such as that of Hey-Groves, are ever indicated.

Dr. James M. Hitzrot remarked that Doctor MacGuire had raised an interesting point about the failure of hyperextension occurring with rupture of the anterior crucial ligament. That had also been his experience. The first case he had seen was some years ago; operation was refused, but the patient got very much the same result as in this case shown this evening.

FEMORAL ARTERIOVENOUS ANEURISM

Doctor MacGuire presented a boy of seventeen years of age, who was admitted to the First Surgical Division of Bellevue Hospital, June 29, 1924, with a stab wound in the middle part of Scarpa's triangle. A large hæmatoma developed which at first did not pulsate. One week later, definite systolic pulsation in the mass was observed. With this there was a continuous bruit, accentuated during systole. The mass was about three inches in diameter, and had a definite expansile pulsation. Because of the continuous bruit, it was felt that there was present an arterial venous aneurism probably arising from either the common or the superficial femoral artery. The patient was kept in bed for two and one-half months with the hope that the aneurismal sac might become endothelialized in case aneurismorrhaphy should be necessary, since ligation of the femoral artery might be followed by insufficient collateral circulation. At the end of two and one-half months, the mass was so steadily increasing in size that further delay was inadvisable and operation was performed.

The external iliac was exposed retroperitoneally through an inguinal incision and a Carrel clip applied. The superficial femoral was exposed below towards the apex of Scarpa's triangle and a clip applied. The femoral vein in this region was angulated to control the venous return. The superficial femoral and common femoral were then dissected free throughout their course, and it was found that they were not involved in the aneurism. An attempt to dissect the aneurismal sac resulted in its rupture with brisk venous hemorrhage. This ceased on ligation of a vein entering its lateral surface. The aneurism had dissected down to the pectineus muscle and up into the iliac fossa, with the anterior crural nerve spread over its anterior surface. The posterior part of the sac wall was not well defined. The profunda femoris artery was found entering the inner surface of the sac and was ligated and divided, and the sac excised as far as possible.

Release of the controls on the external iliac and femoral arteries and femoral vein resulted in no further hemorrhage. The pathologist's report on the aneurismal sac showed that there was as yet no endothelialization, although two and one-half months had elapsed since the time of injury.

The patient made a smooth and uneventful convalescence and was symptom free.

LATE RECURRENCE OF CARCINOMA OF THE BREAST AFTER EXTIRPATION

Dr. Burton J. Lee presented a woman, sixty-three years of age. This patient was operated upon in 1906 by Doctor Tilton, at the New York Hospital. A complete radical operation was done for carcinoma of the left breast.

Her history before the operation showed that about 1902, after wearing a tight waist, she had a swollen left breast, tender to touch. It resulted in a small nodule just under the nipple. There was no increase in the size for about three years when it became tender. It was procrastinated and treated for one year. It grew gradually larger and finally in 1906 an amputation was performed. There was no further trouble until about February, 1922, when shooting pains occurred in left pectoral region and fullness of glands in the neck was noted. Her family history was negative. The patient had had two lactations, with mastitis in the right breast at the second lactation.

The patient was admitted to the Memorial Hospital in May, 1922, at which time she showed diffuse fullness of the left pectoral region and left intraclavicular region. In addition the left supraclavicular area contained a large node somewhat fixed 6 x 4 x 4 cm. There was no involvement along the line of the incision. There was some fullness in the left axilla and a node was palpable about one cm. in diameter. The right breast and axilla were negative.

An X-ray examination of the chest made by Doctor Herendeen, May 12, 1922, showed: "Evidence of slight enlargement of mediastinal glands, but plate lacks definite Röntgen evidence of cancer metastasis."

This case represented a recurrence fifteen years after the operation, and the patient was presented because of the long time interval between the operation and the return of the disease.

The treatment consisted of radium packs on two occasions over the left supraclavicular region and the left axilla. On two occasions nine bare tubes, totalling 9.8 millecuries were introduced into the axillary mass. In addition, she has had three complete cycles of low voltage X-ray treatment over the whole left breast and chest region. Her condition at the time of presentation was one of gradual but slow progression of the disease during the past year.

CARCINOMA OF THE BREAST; ILLUSTRATING THE UNCERTAINTY OF PROGNOSIS

Dr. Hugh Auchincloss presented six cases that had various unexpected features associated with them:

Case I.—A. E. Single, age forty-four. Lump for one and a half years. Presented herself in 1919 with a large lump almost 10 cm. in diameter. X-ray plates showed ilium and several ribs suspicious of metastases. In spite of the lump being large, and a long history of neglect and suspicious X-rays, no axillary metastases were found. Radical removal of the breast was done. A few days ago, a small recently appearing subcutaneous nodule was removed from the scar on her right arm, but no evidences of carcinoma were found. She is apparently well now, five years since operation.

Case II.—S. H. Married, age fifty-four. Had noticed lump three months. Mass large, 4-5 cm. diameter, no axillary metastases found. X-ray report "Indication of extensive metastases of the ribs." Radical removal of breast. Five years later, she had an infection on the dorsum of her forefinger. There was an undue amount of inflammatory œdema. The arm that had previously been free of œdema has now a brawny, persistent œdema especially when submitted to much use. This has been present for one and a half years and is an interesting substantiation of the principles of Halsted set forth in his classic article in the *Johns Hopkins Bulletin* of October, 1921.

This case, as well as the preceding one, indicates the difficulty of being

certain of the X-ray evidences of metastases. She is apparently well now six and a half years since operation.

CASE III.—A. I. Married, age thirty-six. Duration of history before operation eight weeks. The mass was 3 cm. in diameter, and axillary metastases were present. The pathological report mentions "plentiful mitoses." Two and a half years ago she lost some weight, and it was thought this was probably caused by unrecognized metastases. She has had considerable X-ray

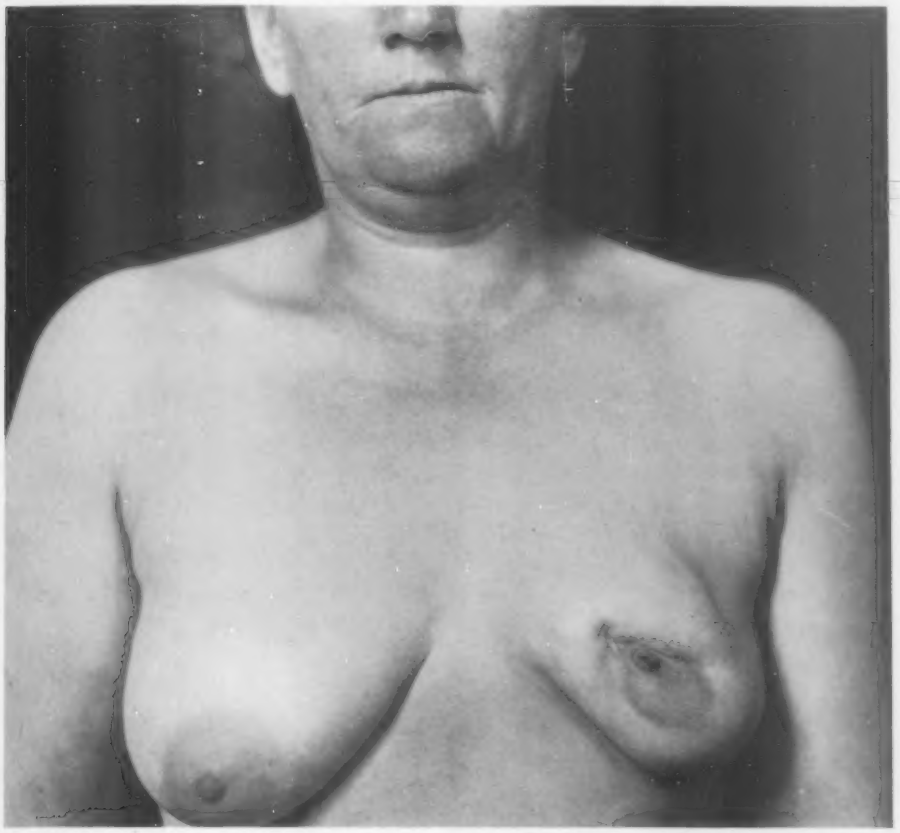

FIG. 1.—Carcinoma of breast (Auchincloss Case VI), two years after beginning of history. Operation refused.

treatment, however, and it has made her sick a few times. Though only thirty-six, with axillary glands involved, and mitoses plentiful, she is apparently well six and a half years after operation.

CASE IV.—M. S. Single, age forty-nine. Ten days before admission first noticed a lump "the size of an egg" in the right breast. It measured 6 x 3 cm. in diameter and axillary metastases were present. Operation the following year. The left breast was removed because of suspicious lumps that proved to be lesions of the so-called chronic mastitis. Râles have been present over the carcinomatous side ever since she was first observed. The reporter believed them to be due to chronic pulmonary tuberculosis, though the sputum has contained no bacilli. In spite of her axillary metastases and tuberculosis, it is now eighty-two months, or nearly seven years, since operation. She is apparently well except for pulmonary tuberculosis.

CASE V.—A. F. Married, age forty-three. Duration of lump six weeks. The mass measured 6 cm. in diameter, and axillary metastases were present. It is now 101 months, or nearly eight and a half years since operation, and she is apparently quite well in spite of the large size of the lump and the presence of axillary metastases.

CASE VI.—E. H. Married, age forty-three. This case is one of the greatest importance in demonstrating the variability of prognosis, and how

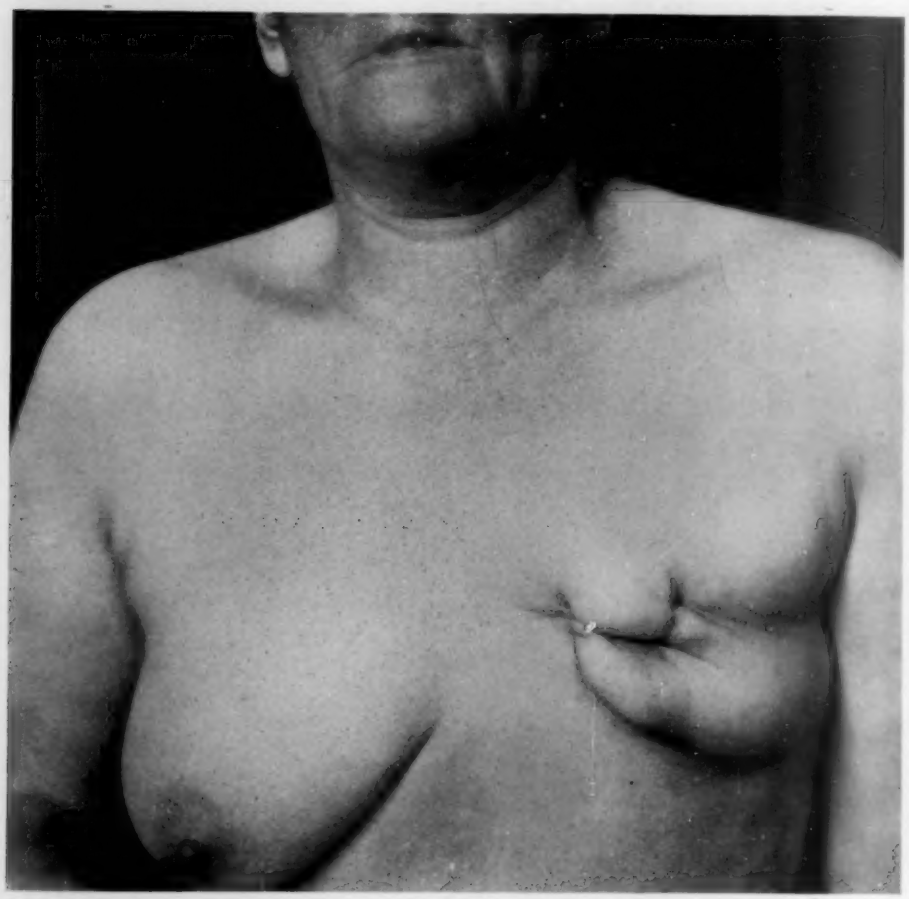

FIG. 2.—Same patient as shown in Fig. 1, four years later. Operation now accepted.

difficult it is to judge of the effects of the various forms of treatment in any particular case.

In 1917, she was first admitted to the Presbyterian Hospital, having noticed a lump in the breast two years and the nipple retracted for one year. A photograph taken in 1917 (Fig. 1), shows the advance the lesion had made up to that time. Chest X-ray showed right diaphragm to be high. She refused to have an operation at that time and was lost sight of until July, 1921, four years later when she was readmitted. The comparison of the photograph taken then (Fig. 2) with the one taken four years previously gives one an approximate idea of the rate of growth during that time.

An operation was then done and axillary node metastases found. This

was three years, three months, ago, and she presents herself now (Fig. 4) apparently quite well and no evidences of metastases. A study of these time elements is extremely instructive: Three years, 3 months since operation; seven years, two months since first examined; nine years, two months since the time she first noted anything wrong with the breast.

If one studies the first photograph and notes the extreme degree of

FIG. 3.—Section of breast from patient shown in Figs. 1 and 2. Note the retractive characteristics of scirrhus carcinoma.

destruction of the breast at that time and notes the relatively slow and slight change in the second photograph four years later, one is almost compelled to believe that the two years' history given by the patient can be but a small fraction of the actual time it took for the disease to advance to the degree shown in the first photograph. Assuming as a conservative estimate that four years can be added to the history before the first admission, this patient may have had cancer of the breast thirteen years or more ago and nine or ten years before the operation.

In years gone by, three years used to be considered a proper time in which to gauge the effects of operative treatment. Now some surgeons use five

years. How sure are we in accepting statistics of series of breast operations that it is the treatment, X-ray or operative, that is being studied? It may be resistance to the disease, or rate of tumor growth that one is dealing with more than the effects of treatment. It is quite true that this is an exceptional case,

FIG. 4.—Same patient shown in Figs. 1 and 2, photograph taken eighteen months after operation twenty-one months ago.

but it is by analyses of such exceptions as well as by mass statistics that the truer estimate of the effects of treatment can be obtained.

THE LATE RECURRENCE AFTER RADICAL OPERATION FOR CARCINOMA OF THE BREAST

DR. GEORGE WOOLSEY read a paper with the above title, for which see p. 932, ANNALS OF SURGERY, vol. lxxx, December, 1924.

DR. BURTON J. LEE in discussing Doctor Woolsey's paper said that he had always considered reappearance of the disease many years after the operation as true late recurrence. Examples were numerous of types of recurrences appearing 6–7 and 17–18 years after the operation, about the wound area or in opposite breast or axilla. He felt that they probably represented an original wide dissemination of the disease with some areas remaining dormant throughout a long period. He felt that it was impossible in every instance to interpret the cause of the delayed reappearance of the

disease. If a large group of these cases could be analyzed it would probably be found that the rate of growth of the tumor process was comparatively slow, and some peculiar pathological features might ultimately be recognized. The study of these late recurrences emphasizes the necessity of focusing more upon the character of the disease than upon the surgical technic employed.

Dr. Edwin Beer said that he had been using pre-operative X-ray therapy for five years in all breast and other carcinomata, including those of the urinary bladder, wherever possible, and it looked to him as if recurrences had been diminished. Cases that were far advanced and that experience taught would recur, had remained in good health. McCarthy had shown that those breast cancers that gave the best outlook were associated with fibrosis and hyalinization, and the pre-operative X-ray seemed to produce a similar pathological change artificially. Perhaps time will convince all of the importance of pre-operative X-ray. Whether post-operative X-ray therapy is as valuable as once claimed, he considered still open to doubt. In Perthes' Clinic in Germany, they claim that those radiated and those not radiated show very little difference. As far as the operation is concerned, seven or eight years ago he had devised a wide operative incision which gave very broad exposure, and which also allowed the operator to make an enormous defect which was filled in by a large abdominal flap. Wide removal and no skimping should be the rule, and by this flap-plastic any defect can be readily covered.

Dr. Hugh Auchincloss dwelt upon the unreliability of statistical reports of series of breast cases. There is still great need for uniformity of opinion among pathologists as to the classification of breast lesions that are called by some pathologists carcinoma and others not. He cited the case of a woman who had been operated on in one of the largest hospitals in one of the largest cities in the country, first in 1901, when one breast was removed for "adenocarcinoma," and again in 1904, when the second breast was removed for "scirrhus cancer." When he first saw her in 1921, the original slides were obtained, an intra-canalicular fibroma found in one and normal breast tissue in the other—diagnosis in which the present pathologist of that hospital concurs. Such a case might well have been included in a statistical series, and is not uncommon.

With regard to bilateral breast cancer, it was his opinion that they represented one and the same disease and not two cancers, as has been suggested. He showed photographs of two such cases. In one of these, the left breast was removed one year after the first symptom had appeared. A peculiarly small cell with deeply straining spherical nucleus, with very little stroma, a microscopical picture of a somewhat exceptional and striking sort that would be listed under the so-called medullary group was found. One year later the right breast was removed, and this same rather unusual type of cell picture peculiar to this case was found. Precisely one year later she died a cerebral death. It would be difficult not to believe that these two cancers were not the same disease.

Cancers developing in pregnancy or first noticed during lactation have

a bad name, and probably deservedly so. Two recent such cases perhaps deserve mention. In January, 1923, an advanced carcinoma of the breast was found in a woman whose breast first became hard and sore in June, 1921, when her baby was born nineteen months previously. The breast was radiated. There was a rather remarkable local disappearance and the patient underwent general improvement that was noticeable to all who saw her. In 1923, she again became pregnant and began to fail rapidly. A Cæsarean section was done eight months later and the baby lived. Metastases were found at the operation in her liver and iliac glands, and she died two days later. The second case had a lump in her breast with marked inflammatory signs two months after labor. It was incised before she came to the hospital. Microscopical sections taken showed no carcinoma. Other abscesses were incised on the basis of this report, but the lesion fungated and soon took on the appearance of an ulcerating carcinoma of large size. Further sections were removed and carcinoma found. She was then X-rayed with remarkable diminution in the size of the whole lesion so that eventually it was decided to rid her of the ulcerating lesion by doing a radical procedure and graft. It was expected she would not live more than a very short time. No axillary glands were found to be involved and she returned to the follow-up clinic only a few days ago, five months after the operation, having gained much weight, with excellent color and apparently in splendid health.

With reference to the necessity for careful pre-operative study of cases, he showed the X-ray plates of a case that had been "advised operation" elsewhere, but had been referred for further study. There were metastatic rarefactions in both humeri, many vertebræ, ribs, all the pelvic bones and the upper ends of both femora. The whole pelvis was filled with the growth on pelvic examination. Quite apart from such a case are those where a definite metastatic focus can be found only after a most complete physical examination. It is proper to do a laparotomy and explore the liver if there be reasonable suspicion of its involvement, before submitting a patient to radical mastectomy.

With regard to radiation, great caution should be taken in using the high voltage, massive doses. Burns of the surface of frightful extent and persistency, severe toxæmias, and fatal lung changes had been seen.

Local, temporary regressions by radiation are not infrequent, but it is entirely too soon to gauge its value at the present time.

The interpretation of symptoms occurring some time after operation, suggesting metastases elsewhere, have been interesting. A moderate lymphœdema brawny arm has existed for the greater part of fourteen years in a case operated on by Doctor Blake in 1910 and observed in the follow-up clinic by Doctor Auchincloss for many years. The occurrence of a brawny arm, following a simple hand infection five years after the mastectomy, and still persisting after one and a half years of observation, was demonstrated in the second case report. This case had an interesting bearing on the reports of Matas and Halsted on lymphœdema.

Two cases had hæmiplegia shortly after the operation, yet were living, one five, the other six years later.

Two cases had developed herpes zoster over the back and lateral costal region without subsequently showing signs of metastases. Small subcutaneous nodules have appeared in or near the scar that have been removed and found to contain no carcinoma cells, though this is the exception rather than the rule. Not infrequently are râles heard on the affected side. Though lung signs must be regarded with suspicion, some of these cases have lived many years and do not necessarily mean metastases.

As regards the operation, he believed in making it a very extensive one, that a fascial dissection be carried out and that, in spite of Handley's advice to the contrary, a wide skin removal be done, with grafting when needed.

Dr. Francis Carter Wood (by invitation) said there is still no real scientific or clinical knowledge which permits final judgment on the value of pre-operative radiation. There are many assumptions made by radiologists that have no foundation in fact, one being, for example, that radiation closes the lymphatics. Clinically it should be perfectly evident that pre-operative radiation does not close the lymphatics as invasion of skin areas after heavy radiation is not infrequent. Experimental work has also shown that the lymphatics in animals cannot be closed by the X-ray, although the terminal arterioles can be. Another objection is that the cancer cells cannot be seriously damaged without equal damage to the surgical field. If 50 per cent. of the cancer cells are killed, 50 per cent. are left in perfect health at a sacrifice of one to two weeks' time. If the tumor shrinks the patient may refuse to be operated on at all. But there is no evidence that sufficient damage is done to the tumor cells to warrant the delay in using pre-operative radiation. If all the cancer cells could be killed surgery would be unnecessary. From a practical point of view, therefore, the procedure has nothing to recommend it.

As to post-operative radiation, that is also somewhat in the experimental stage, but on a much firmer footing because one does see superficial recurrences disappear. Only long clinical experience can determine its final value. One thing, however, the surgeon seems to forget in criticizing the failures: the X-ray cannot make cancer grow where cells have not been left. One operator complained to me that his results in breast cancer were much worse since he had recommended post-operative radiation to his patients. His assistant, however, offered another explanation, which was that his chief had been much less careful in his work since X-ray had become available as an adjunct to his surgery. Perhaps increasing age also had something to do with it.

The great difficulty in drawing conclusions is complicated by the fact that there are three different degrees of resistance to X-ray in carcinomata which cannot be differentiated under the microscope; there is also enormous variation in different types of tumors.

In general it is best to remove the tumor surgically up to the borderline of operability and then ray. More skin should be removed than is commonly done, for better results as regards skin recurrences are obtained when large

areas of skin and fascia are removed. Then he counselled that all patients should have post-operative radiation for at least two years. It can be done cheaply and effectively without interfering with the patient's work. But there is one very important phase in all post-operative radiation. Once a primary or recurrent tumor has been radiated and has become quiescent it should not be excised, for rapid and extensive recurrence is apt to follow. Old channels are opened and passage of the tumor cells into the rest of the body is brought about by the surgical procedure.

INCISION FOR RADICAL AMPUTATION OF BREAST PERMITTING CLOSURE OF EXTENSIVE DEFECTS

Dr. Edwin Beer said that at the commencement of a radical operation

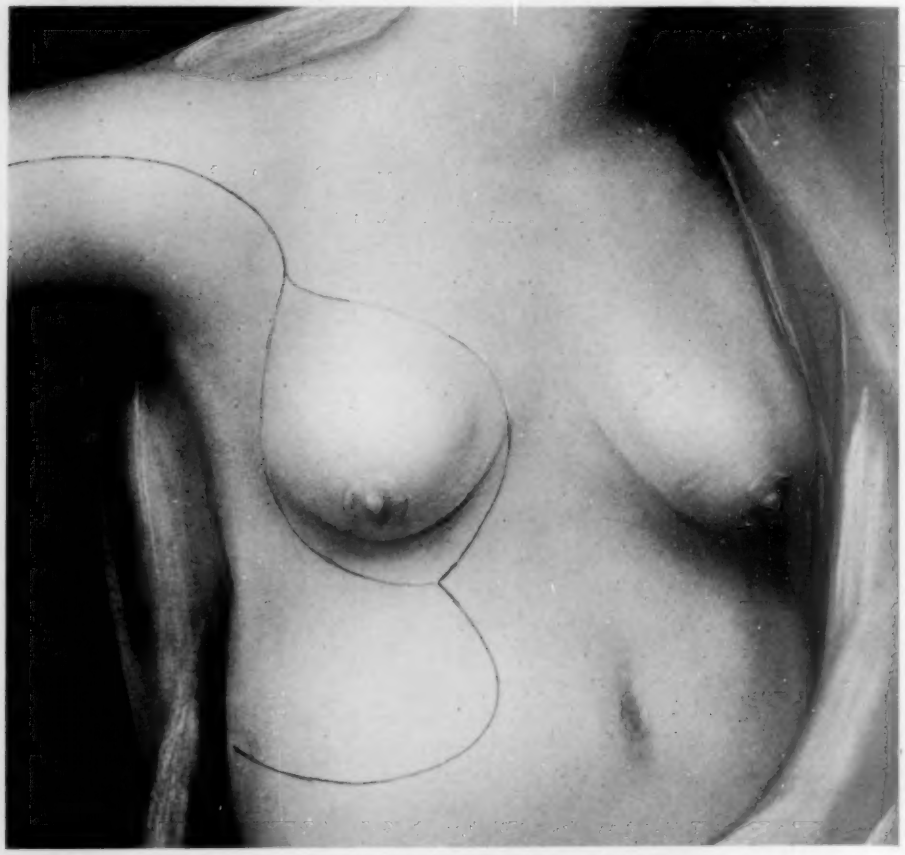

Fig. 5.—Incision for radical removal of cancerous breast.

on the breast, one need not worry about closing the defect resulting from the excision. There is always liable to be a tendency to skimp when planning the lines of incision if one is in doubt as to the feasibility of bringing the edges of the skin together at the conclusion of the operation. He described a technic which has been in use by him for almost eight years and which has allowed of the closure of the widest defects (Fig. 5).

He believed it to be generally conceded that to get rid of the carcinomatous disease, a wide excision, including a wide excision of the overlying skin, is absolutely necessary. If the excision of the skin is very wide, the surgeon must make use of one or the other of the plans already described in the literature. He must either make use of such a type of incision as Jackson recommended; or he must undercut the skin flaps very extensively; or he must raise

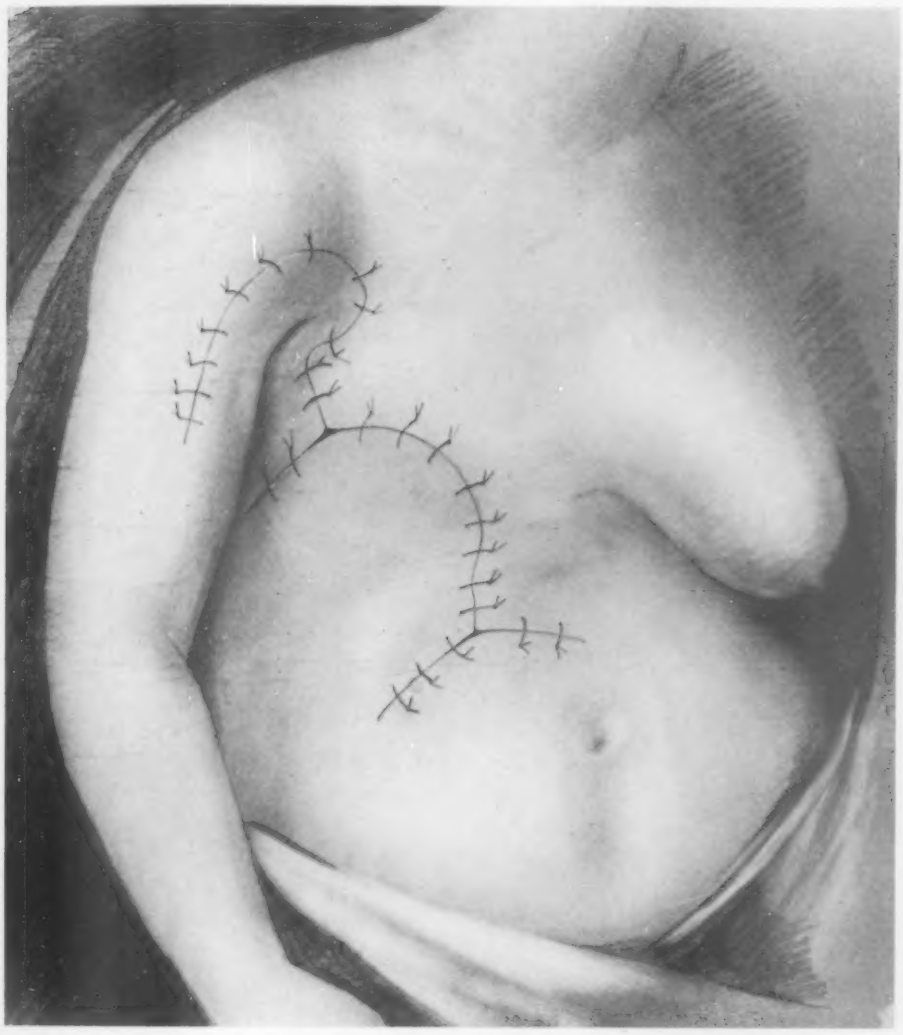

FIG. 6.—Suture line of completed operation.

up the opposite breast, undercutting all the adjacent skin and bring the opposite breast partially into the defect created by his excision. In other cases it may be necessary to cover with skin grafts the denudation left after partial suturing of the wound.

To avoid these various methods of closing large defects, he had made use of a very large skin fat flap which is cut off from the anterior abdominal wall

with a very wide pedicle posteriorly. This large flap can be made as long and as wide as is necessary, and after a little experience, the operator will find that he can readily gauge the size flap that is necessary to fill in the defect on the chest wall. The raising of this flap over the corresponding rectus muscle allows excision of the anterior rectus sheath as recommended some years ago by Handley.* After this large flap is swung into place, it is sutured as indicated in the illustration (Fig. 6), and as there is very little tension on the edges of the flap or the skin over the chest, necrosis rarely develops. At the upper margin, where the vertical incision meets the transverse incision, there is occasionally the slightest disturbance in one of the edges of the wound. The defect on the anterior abdominal wall made by switching the large flap upward, is readily closed by the mobilization of the adjacent superficial fat and skin. The two accompanying illustrations (Figs. 5 and 6) describe better than words the general course of the incision and the appearance after the flap has been thrown into place and the wound sutured.

* Whether this step is essential to radical cure has not been as yet proven.

CORRESPONDENCE

ADHESIONS OF THE ILEUM—THE RESULT OF APPENDICITIS

EDITOR, ANNALS OF SURGERY:

Sir:

Recent publications in the ANNALS OF SURGERY have prompted the following remarks based upon the observations of many years.

In inflammation of the appendix, the contiguous cæcum and ileum are frequently involved resulting in more or less peri-appendical adhesion formation. Consequently it follows, as an act of common sense, that parietal incisions should be of dimension and in situation sufficient to afford ample means to examine the whole lesion and to release adherent organs from the bands which bind them in and around the pelvis. Such bands, in my experience, exist in greater or lesser degree in at least 30 per cent. of cases. These adhesions, if unheeded, discredit appendectomy by reason of the continuance of pre-operative symptoms and in some cases determine an ultimate acute intestinal obstruction. Except in instances of obvious spreading peritonitis or of sepsis in which there is evident danger of diffusing infection, the neglect of explorations for possible complications is unworthy of the enormous advantages which aseptic work has brought to the surgeon for accurate diagnosis and treatment of intra-abdominal conditions. In proof of this statement, during the summer just past, my colleague, Doctor Liston, and I found organized adhesions kinking and binding down the last few inches of the ileum into the pelvis in five consecutive operations for "ordinary" appendicitis. In three of these cases the adhesions were in the form of bands so dense and fibrous that strong scissors had to be employed to divide them. During the same period in this group of cases, exploration detected three concomitant infected gall-bladders with calculi, two cystic ovaries of moderate size, and two small extramural uterine myomata, all of which were dealt with at the same time, or shortly thereafter. Primary liberation of adhesions which angulate and fix the ileum to the pelvic brim considerably facilitates exposure of an appendix and also helps to mobilize the cæcum.

The prevention of the formation of post-operative adhesions should ever engage the attention of the surgeon, by covering with peritoneum as far as possible, all raw surfaces remaining after separation of adhesions. In my judgment the incision after the intermuscular method of McBurney does not admit of proper local examination and much less of the necessary procedures of dealing with intra-abdominal conditions which are found in a large percentage of cases of even "ordinary" appendicitis.

The proper incision rather to expose a diseased appendix and to efficiently deal with complications is the vertical one through the right semilunar line. As a commentary upon these observations, I may cite the case of an American lady who recently came to operation for the relief of ectopic gestation who

had been operated upon nine years before in the United States for appendicitis. Upon opening the abdomen, the cæcum was found adherent to the abdominal wall. There was no trace of an appendix, but the adjoining ileum was kinked and glued to the pelvic brim by a broad dense adhesion, the division of which was necessary in order to obtain access to the pelvis. I have found that whenever the ileum is bound down by adhesions to the pelvic brim, a segment of gut distal to the adhesions has invariably been hypertrophied, if not actually congested, while immediately proximal to the line of adhesion, the ileum is normal in appearance and texture. I infer from this that there has been present an ascending infection from the primary infected appendix which has been arrested at a casual point of sag in the comparatively thin-walled small gut followed by the passage through its walls of an infection sufficient to create the external inflammatory focus which resulted in the formation of the adhesions in question.

JOHN O'CONOR, M.D.,
Buenos Aires, Argentina.

OVARIAN CYST OF GREAT SIZE REMOVAL WITH RECOVERY

EDITOR ANNALS OF SURGERY:

Sir:

The large ovarian cyst here reported is evidently more than a mere anachronism. Even in the days of large cysts this one would have ranked well for size among its contemporaries, weighing, as it did, one hundred and thirty pounds. It appears to occupy a better than medium place among such curiosities in medical literature. And cysts larger than this one, it is to be noted, have a high operative mortality.

The following cysts of the female genitalia are mentioned in Gould and Pyle's "Anomalies and Curiosities of Medicine," and in a number of individually reported instances. I list the names of surgeons reporting cases. The numerals indicate the weights of the respective cysts in pounds: Dayot, 65; Boerstler, 65, Bixby, 70; Alston, 70; Pemberton, 72; Gregory, 80; Lampson, 81; Bleich, 85; Keith, 89½; Kelly, 100; Homans, 105; Kelly, 116; Peliza, 121; Peliza, 130; Richardson, 130; McGillicuddy, 132; Rodenstein, 146; Tozzeth, 150; Briddon, 152; Harley, 164 (fatality); College of Physicians and Surgeons, Philadelphia case, 182½; Ward, 221 (fatality).

Our patient, a married woman, thirty-nine years of age, came into the Middlesex Hospital, August 12, 1924, stating that she had first noticed abdominal enlargement in the preceding May, and that she had then believed herself pregnant, although she had had regular menstruation before that date. She had no intestinal or urinary disturbance and no heart or lung symptoms, and she had done a part of her household duties up to a few days of the time of her coming to the hospital. The pulse ranged from 84 to 105 and was small and empty. The heart sounds were weak. The blood-pressure was 160 over

78. The hæmoglobin was 90 per cent., the red cells 3,312,000, the whites 4900, the polymorphonuclears 72 per cent. There were no casts, sugar or albumen in the urine. The blood chemistry was NPN 29 mg. per 100 c.c. of blood, creatin 2.4 mg.

Owing to the deficient vascular system with untrustworthy heart and weak and empty pulse it semed wise to risk a possible peritonitis from tapping the cyst at a date sufficiently previous to the laparotomy to allow the heart time to rest from its load and to become digitalized. By tapping, 95 pounds of an olive green fluid were withdrawn. This fluid was alkaline, with a specific gravity of 1028, and containing a few large (endothelial) cells, a few leucocytes and red blood cells.

FIG. 1.—External appearance presented by ovarian cyst weighing 130 pounds. Removal followed by recovery.

At operation one week later a tumor weighing 40 pounds was removed. It was made up of many cysts, and the cyst that had been tapped did not contain more than 2 or 3 quarts of fluid, showing that no re-accumulation had taken place, so that the untapped mass must have weighed a little over 130 pounds. Some fluid was lost at the time of operation in attempt to tap another cyst. The pathological report was cystadenoma pseudomucosium.

The patient was unable to lie on her back without distress, and the tumor could not be balanced in such a position on the operating table so that the operation was done with the patient lying on her right side. An incision about twelve inches long was made in the left semi-lunar region, and the pedicle of the cyst was clamped and tied off by sense of touch by reaching down in the pelvis. This course was decided on after exploration disclosed the fact that the upper surface of the mass was quite firmly attached to the structures in the upper abdomen. The incision was stretched and the tumor was made to slide down and out until the upper attachments were dragged into view so that they could be dealt with. The space left in the abdomen seemed enormous. A person of moderate size could have curled up in the vacancy. A large amount of saline solution was poured in to make amends for what we had taken out. Nothing untoward marred the post-operative history except that a diarrhœa persisted for two weeks, due no doubt to the decompression of the intestines.

As to how it was possible for a tumor to attain such a size in a civilized community, one can gain some information from the picture. The patient was a large, powerful woman weighing over 200 pounds before the tumor started to develop. The tumor did not cause a ptosis of the abdomen, but was carried in a well supported position and did not put the host out of business until late in its development. A second factor in accounting for the size of this tumor was the low mentality of the patient.

We owe a word of thanks to Dr. E. R. Lampson of Hartford, who saw the case about ten days before the operation, and sympathized with us over the condition of the patient's heart and pulse, and offered us valuable advice as to a preliminary tapping.

JOHN E. LOVELAND, M.D.,
Middletown, Conn.

AN IMPROVED OPERATING TABLE, FOR GENERAL SURGERY, PROVIDING NEW FEATURES FOR UROLOGIC AND GYNÆCOLOGIC WORK

EDITOR ANNALS OF SURGERY:
Sir:

The table which I wish to describe is so fully depicted in the illustrations that very little comment is necessary. As seen in Fig. 1 when the table is in a horizontal position, it may be used for kidney operations. A special elevator is provided which has the advantage that it can be slid up and down to any required position on the table, not being fixed in one place on the table, as is usually the case. With the patient upon his side, by turning a crank operating the double screw and parallelogram mechanism, Fig. 2, it is possible to elevate the patient as greatly, as may be required, for an extra-peritoneal exposure of the kidney through the loin. The illustration does not show an additional mechanism which is furnished with this table, the object of which is to hold the chest vertically with one side up. This mechanism consists of two padded discs, Fig. 3, which are attached to elongated shoulder rests which support the back and chest, holding the patient fixed in this position. As the shoulder rests can be moved by a ratchet mechanism, these fixation discs can be placed in any position along the back or chest as is desirable. With the kidney elevator and shoulder pieces removed, the table may be used as a flat horizontal operating table.

An especially good Trendelenburg position is afforded, Fig. 4, and not only is it possible to depress the head much more than usual, but the leg supports, which slide upon the adjustable bars attached to the lower end of the table, separate the thighs and make it possible for the operator or his assistant to carry out manipulations in the urethra, vagina or rectum during the operation. This is especially advantageous in abdominal operations, bladder operations, suprapubic prostatectomy and also for rectal operations, in which both an abdominal and perineal exposure are desirable. The ability of the

operator or his assistant to insert a finger or instrument into the rectum or vagina or urethra during abdominal operations is often important.

For operations upon the perineum (prostatectomy, stricture) and for rectal operations (hemorrhoids, resections, etc.), a splendid exposure is obtained by means of a special elevator shown in Fig. 6. This is placed upon the table, the lower end engaging upon the table-frame and the upper end upon the movable shoulder rests, which are operated by a crank handle and ratchet mechanism. This elevating mechanism lies flat upon the table beneath the patient until anæsthesia is produced. The table is then wheeled into the operating room and the patient placed in perineal prostatectomy position by the following manœuvres: The extension plate beneath the feet and legs is removed; the side bars are elevated and covered with large rubber tubes (hose); the legs are raised up and hooked over these tubes, Fig. 4; the head of the patient is elevated so that the body slopes downward towards the buttocks; the handle bars are made to move forward by the crank handle working the ratchet upon the side of the table. As this pushes the patient towards the lower end of the table, it also raises the elevator attached at the lower end, this operation being continued until the perineum is well elevated and projects beyond the end of the table. The head of the patient is then depressed, by turning the wheel at the side of the table, thus elevating the perineum and bringing the patient into a perfect position for prostatic or rectal operations. This special elevating mechanism, Fig. 6, has an automatic release which comes into play in very short patients, making it possible to continue pushing the patient towards the end of the table after the pelvic elevator has reached a vertical position. These features, which are new, make it possible to place the patient, who has been anæsthetized while flat

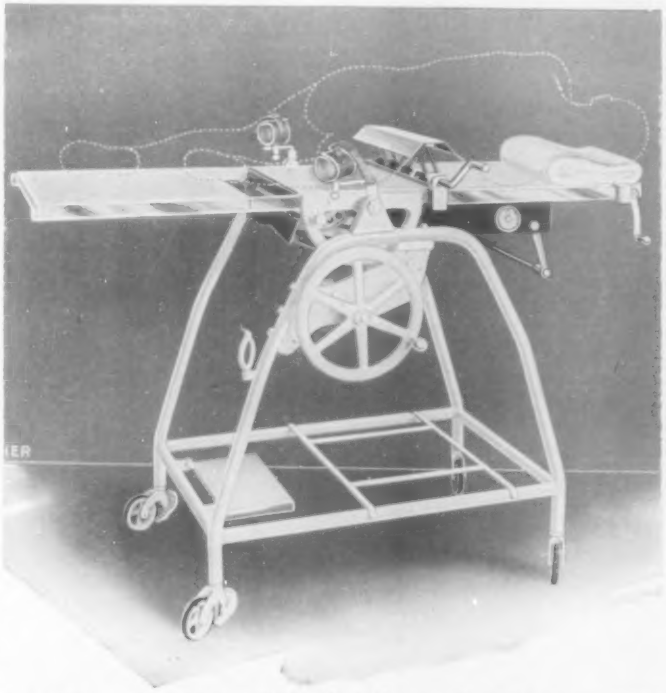

FIG. 1.—Young's operating table in horizontal position with special kidney elevator for lateral nephrectomy position; padded discs to hold patient vertical are not shown. Flat Buckey diaphragm shown in this table is not supplied on tables for purely operating room work.

on the table, in a perineal or rectal position with a minimum of disturbance. They are practically automatic. The position thus obtained, with the pelvis flexed upon the spine and the thighs separated and markedly flexed, is necessary for the proper performance of a perineal prostatectomy.

For operations upon the genitalia such as hypospadias, the table furnishes an admirable position in which the body of the patient is horizontal, thighs separated and the legs hooked over the side bars, while the operator sits upon a stool between the thighs in position to carry out plastic operations upon the penis. In the operation for cancer of the penis with excision of the glands of both groins, this position makes it possible for the operator or an assistant to stand between the thighs with an assistant at the side of the table opposite each groin. Simultaneous excision of the glands of both groins can thus be carried out by two operators and the duration of the operation greatly reduced.

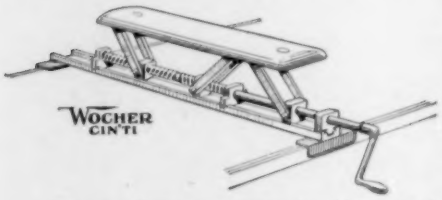

FIG. 2.—Young's elevator for kidney and gall-bladder operations. It moves back and forth upon the table, being held in position by lateral cleats and is operated by a double screw and parallelogram mechanism.

In the operation for the removal of the retroperitoneal glands in tumor of the testicle, the patient is placed upon his back and the kidney elevator used beneath the lumbar spine to bring the posterior abdominal wall forward, thus greatly facilitating the exposure and dissection of the deep retroperitoneal glands along the vena cava and aorta. For intra-abdominal operations upon the intestine, stomach and gall-bladder, the same position is used with much advantage.

FIG. 3.—Padded discs, attached to shoulder supports, hold chest rigidly on one side during kidney operations. Wrist cuffs also shown.

For certain operations upon the foot, leg or thigh, the member can be supported upon a board lying upon one of the side bars, the foot-piece having been removed from the top of the table. The other leg is out of the way. This allows the operator and assistants to assemble on each side of the extended thigh. The kidney elevator can be used for elevating the pelvis and the side bars dropped out of the way during application of a plaster cast upon the lower extremity.

When not in use for operations the table can be employed for cystoscopy and simultaneous X-ray examination, but we have another of these tables for this work. The standard, supporting the X-ray tube, is easily attached or detached. The table top is covered with either sheet aluminum or with a slab of Bakelite, both of which permit the passage of X-rays. The Liebel Flarsheim Company have made at my request a special new flat Buckey diaphragm which fits within the side bars and beneath the top of the table as shown in Fig. 7. This new flat Buckey diaphragm is not only more compact than the original curved Buckey, but being closer to the X-ray film

gives better pictures. It may be used for other X-ray work, and when used alone (not in this table) gives admirable pictures. It will, I feel sure, replace the cumbersome curved Buckey diaphragm now in general use. The X-ray tube is held upon a stand attached to the side of the table from which it can be removed at will. Figure 6 shows patient in the usual position for cystoscopy with the tube in position for an X-ray of the genito-urinary tract. When the tube is not in use the supporting frame is pushed up out of the way, so as not to interfere with cystoscopic manipulations and descent of the patient from the table. The new flat Buckey is not essential, and pictures may be made without it.

FIG. 4.—Table in Trendelenburg position. Patient's thighs are separated and knees hang over crutches which slide upon the movable side bars. Note horizontal drainage pan.

As shown in Fig. 7, X-ray tube is fixed at the proper focal distance from the diaphragm. Provisions are made for stereoscopic pictures which have been most successful in their results.

One of the most important features of our combined X-ray and cystoscopic table is the ability to take radiographs in varying positions. Pyelograms should always be taken in both horizontal and vertical positions to show the movement of the kidney, in order to determine the presence of undue movement, ureteral kinks, etc. Figure 8 shows a patient for a vertical pyelogram or a simple X-ray. Figure 7 shows patient in an inverted position to get the extreme upper limit of the kidney by means of a pyelogram. This same position may be used for filling the bladder with air, by negative pressure, and has been successfully employed by Neill * in operations with the Kelly

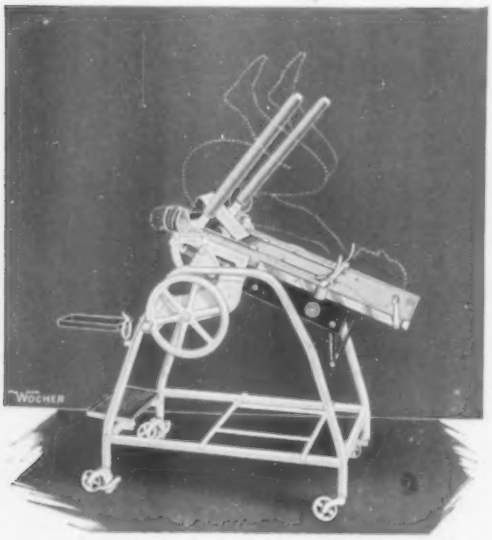

FIG. 5.—Table with patient in position for perineal and rectal operations. Legs supported by movable side bars covered with rubber tubes. Pelvis flexed on spine with Young's automatic perineal elevator.

* Neill: Journal of the American Medical Association, 1922, vol. lxxix, pp. 2061–2063.

endoscope in women and also in men. We have thus, in the same frame, a table which may be either utilized for the operating room or for cystoscopic studies or for simultaneous X-ray work. In our practice we have two of these tables, not provided with the flat Buckey diaphragm or other X-ray equipment, in the operating room. In the cystoscopic rooms we have two of these tables which are provided with X-ray equipment and flat Buckey diaphragm for our regular urological diagnostic work. The table above described has many original features as here indicated, the principal of which are:

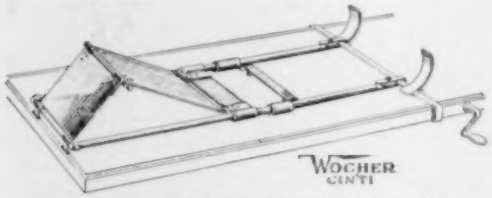

FIG. 6.—Young's automatic and perineal elevator operated by rack and pinion mechanism which moves the shoulder rests forward, at the same time elevating the pelvis. When elevator reaches maximum position an automatic release on each side allows the shoulder rest to continue movement until patient is pushed up into the proper position.

The single screw mechanism which manipulates the entire table top, without cross bars, thus giving a great mobility to the top of the table; movable side bars which support the lower third of the table top in a horizontal position, but when the top piece is removed, these side bars may be used as leg rests or to support the thighs for perineal positions and also for the Trendelenburg position; an automatic perineal elevator for prostatic and rectal examinations and a movable kidney elevator which may be placed upon any part of the table; padded discs, attached to the shoulder rests, providing a simple method of holding the patient's chest

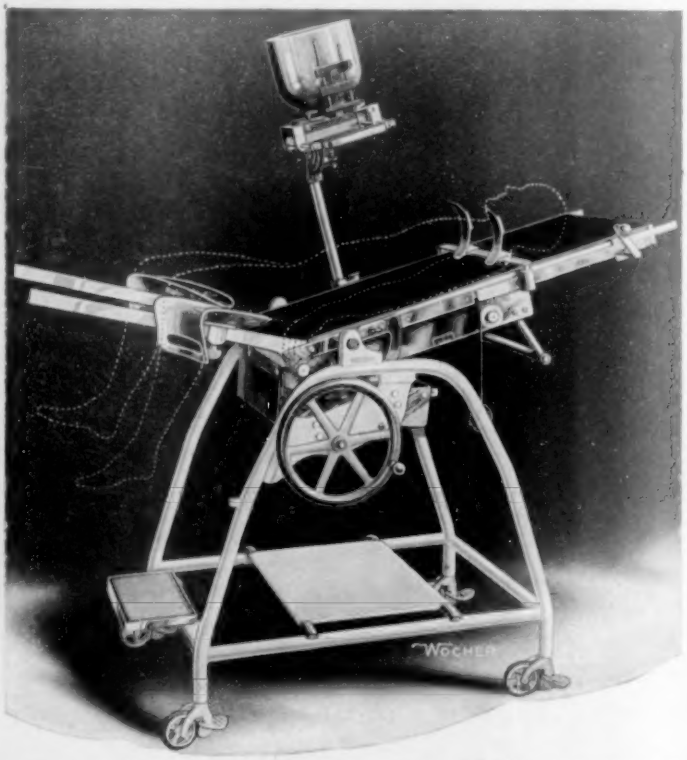

FIG. 7.—Young's combined cystoscopic and X-ray examining table with new, specially designed flat Buckey diaphragm and the tube stand fixed, with tube in focus on diaphragm. This is the same table as the operating table to which the X-ray equipment is simply added. Table in position for pyelograms to show extreme upward limit of movable kidneys. This position may also be used to fill the bladder with air by negative pressure—Kelly cystoscope.

vertically for kidney operations. These features, together with the ability to add an X-ray standard and the new flat Buckey diaphragm, make the table, in my opinion, a very valuable addition to the operating room for both general and special purposes, as well as for urologic and X-ray work.

Résumé.—The table presented has the following new, original features.

A wide excursion of movement by means of a single worm and wheel gear.

Adjustable shoulder supports worked by rack and pinion.

Movable side bars.

Adjustable knee and leg supports.

An automatic perineal elevator.

Adjustable padded discs for kidney position.

A movable kidney elevator, separate from table.

A drain pan which remains horizontal.

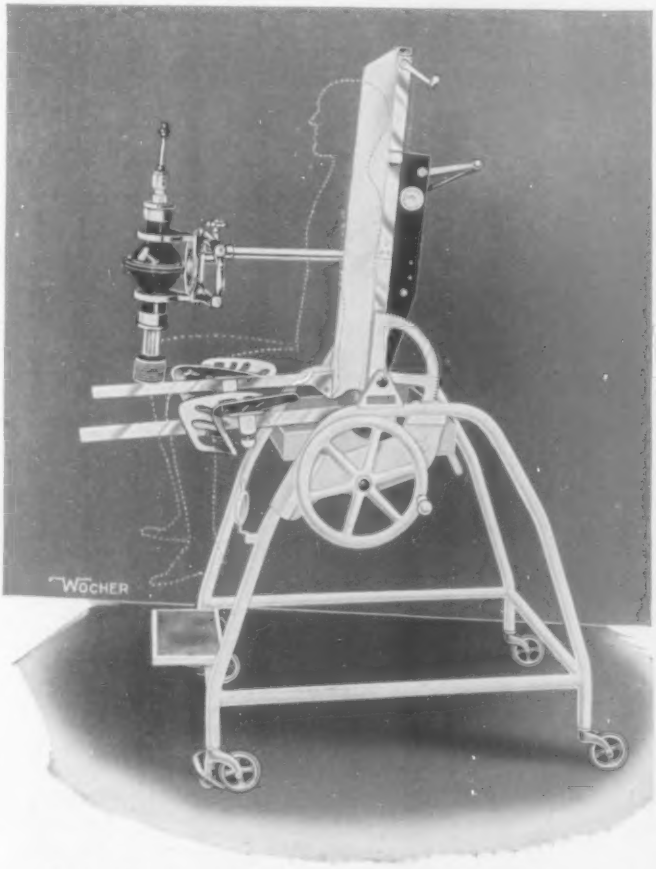

FIG. 8.—Young's combined cystoscopic and X-ray table with patient in vertical position sitting upon the movable side bars. This position is used for vertical pyelograms which show the extreme movement of the kidneys.

A permeable table-top through which X-ray may be taken.

If desired the same table may be transformed into a combined cystoscopic and X-ray table, the plates being taken either above or below the permeable top.

In addition a new flat Buckey diaphragm has been designed, which fits within the frame beneath the top.

This table, besides being thoroughly practical for ordinary operations, is quickly transformed into:

A Trendelenburg position with thighs separated.

A perineo-rectal position with pelvis flexed on spine.

Various positions for cystoscopy and proctoscopy.

A lateral kidney position with body held immovable between padded discs.

A position for gall-bladder operations, the back elevated by the "kidney elevator."

The table has been constructed by the Max Wocher Company, and the Liebel Flarsheim Company, of Cincinnati, from the models made at the Brady Urological Institute.

HUGH H. YOUNG, M.D.,
Brady Urological Institute,
Baltimore, Md.

To Contributors and Subscribers :

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 145 Gates Ave., Brooklyn, N. Y.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS *of* SURGERY
227-231 So. 6th Street
Philadelphia, Penna.